Vol. 10, No. 6

JUNE, 1955

AGRICULTURAL CHEMICALS

In This Issue:

Fertilizer Enforcement Problems

Fruit Spray Programs

NPFI Meeting

Control of Soil Insects

Arkansas FOA Aid

Georgia Ag Station

Fungicide Tests

Fertilizer Consumption Report

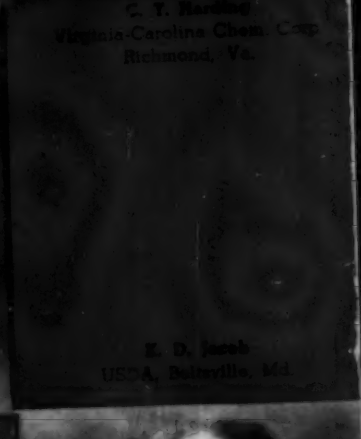
Caking in Fertilizer

Indiana Fertilizer Plant

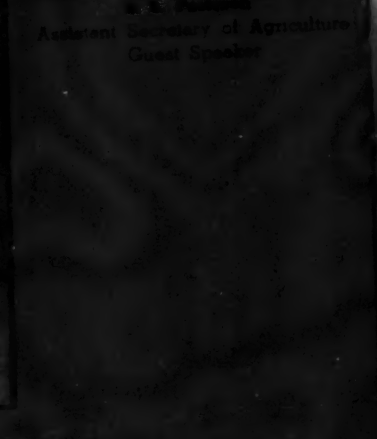
R. C. Berry
Virginia Dept. of Agriculture
Richmond, Va.

C. T. Harding
Virginia-Carolina Chem. Corp.
Richmond, Va.

John Cooper
Washington, D. C.



E. D. Jacob
USDA, Beltsville, Md.



A. E. Peterson
Assistant Secretary of Agriculture
Guest Speaker

In the early hours

OF THE CHEMICAL AGE

Phytomycin*

THE NEW ANTIBIOTIC FORMULATION

Now accepted for

BLUE MOLD AND WILDFIRE ON TOBACCO: BLACKLEG AND SOFT ROT ON POTATOES

PHYTOMYCIN, a fresh idea that works, has advanced the conquest of plant diseases a long stride closer to fact. Tobacco and potatoes can now be planted with the confidence that they will be protected from the ravages of disease. It's the kind of control so readily measured in terms of greatly increased, better quality yields. These important new recommendations along with the maximum control obtained for diseases of apples, pears, tomatoes and peppers firmly establish PHYTOMYCIN's position in agriculture.

Keep pace. Use the new way to control disease —**PHYTOMYCIN.**

EFFECTIVENESS: Controls fireblight on apples and pears and bacterial leaf spot on tomatoes and peppers and now—blue mold and wildfire on tobacco and blackleg and soft rot on potatoes.

SAFENESS: Safe to plants. Does not injure trees, reduce set or impair fruit finish.

EASY-TO-USE, ECONOMICAL: Entire contents of half pint (contains 6.4 oz.) and quart bottles may be used in 100 and 500 gallon sprays respectively. Bottles also graduated for lower concentrate sprays.

Also available in 50 gallon drums for repackaging.

PHYTOMYCIN
is Manufactured by
E. R. SQUIBB & SONS,
A Division
of Olin Mathieson
Chemical Corporation

MATHIESON

OLIN MATHIESON CHEMICAL CORPORATION
Insecticides Division
ONE PARK AVE., N.Y., N.Y. • BALTIMORE 3, MD. • LITTLE ROCK, ARK.

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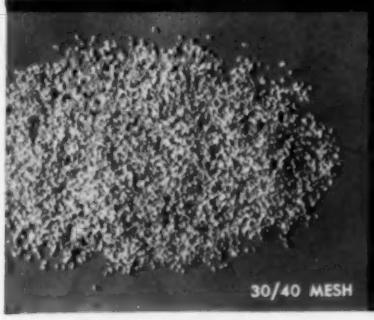
what GRANULAR ATTACLAY *can do for YOU in the fast-growing* GRANULAR MARKET



Shown here are several grades of Granular Attaclay. These photographs may help you select the mesh most suitable to your product. (Granules shown are actual size.)

Want a liberal share of the ever-expanding granular pesticide market? Granular ATTACLAY and M&C technical assistance can help you get it faster and easier.

MAKE A SUPERIOR PRODUCT! Granular ATTACLAY is produced from the same highly sorptive material as trade-preferred ATTACLAY. It combines ideally with toxicants. It suffers minimum breakdown in processing. And it's a most versatile and efficient means of formulating granular pesticides, fungicides or herbicides.

WIN A PROFITABLE MARKET! Growers who never used granular formulations before are demanding them now. The market includes small-package business for home lawns and gardens, as well as volume shipments for the control of mosquitos, pasture pests, corn root-worms and other insect bandits.

Another interesting above-the-ground use: Citrus tree mealy bug control, through control of the ants that aid and abet them. Natural insect enemies of the mealy bugs will destroy them if left undisturbed. Trouble is that ants continually molest these predators. Granular pesticides at the foot of the tree will control ants and leave predator insects free to destroy mealy bugs. And there'll be no poisonous residue left on fruit from dusting or spraying.

New 8-Page Bulletin, Technical Help, Samples.

Whatever your formulation, production or application problem, our years of field and laboratory experience with granular grades are immediately available to you. For prompt assistance, check and mail the coupon today.

ATTAPULGUS PRODUCTS *from*

MINERALS & CHEMICALS CORPORATION OF AMERICA

210 W. WASHINGTON SQUARE, PHILADELPHIA 5, PA.

ALWAYS A BETTER WAY...

MINERALS & CHEMICALS CORPORATION OF AMERICA
Dept. P, 210 W. Washington Square, Philadelphia 5, Pa.

☐ Please send new 8-page bulletin with full technical data on Granular Attaclay.

☐ I'm interested in free test samples of the following mesh sizes_____

name_____ position_____

company_____

address_____

city_____ zone____ state_____

OLD soils need NEW life!

revitalize them with—THE IRON CHELATE

PERMA GREEN IRON 135

for BIGGER, BETTER and FASTER-GROWING CROPS

UNTREATED

TREATED

ORANGES

Four ounces to one pound PERMA GREEN IRON 135 per tree produces dark green leaves and more, larger and better colored oranges.

When iron is lacking and plant leaves turn yellow, PERMA GREEN IRON 135 makes them dark green in two weeks' time.

PERMA GREEN IRON 135 is an organic chelate that moves upward with the sap to rejuvenate the entire plant.

PERMA GREEN IRON 135 *now produces* —

— more and juicier oranges and grapefruit
— more and larger nuts
— more nutritious vegetables
— larger and more beautiful roses
— deeper-green leaves on azaleas and rhododendrons
— more attractive ornamental trees and shrubs.

Write for detailed information on PERMA GREEN IRON 135 for plants and reprint of scientific article on CHELATES.

Developed by RESEARCH • Proved by PERFORMANCE

for quality products, remember —

Refined PRODUCTS CORPORATION

Manufacturing Chemists • Lyndhurst • New Jersey

SUNFLOWERS

Grown in nutrient solution. Small yellow plant at left treated with iron sulphate. Large dark green plant at right treated with PERMA GREEN IRON 135.

GARDENIAS (Greenhouse)

Iron is very important for gardenias. Treat each bush with 1/16 to 1/8 level tablespoonful PERMA GREEN IRON 135 to insure dark green leaves and large pure white flowers.

AGRICULTURAL CHEMICALS

APFC + NFA ↓ NPFI-1955

A Monthly Magazine For the Trade

•

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RALPH DORLAND
Advertising Manager

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This Month's Cover

Panel Members of forum on "Problems Relating to Fertilizer-Pesticide Mixtures" at first meeting of the National Plant Food Institute, June 12-15, Greenbrier, White Sulphur Springs, W. Va. (See page 51 for story.)

JUNE 1955
Vol. 10 No. 6

In This Issue:

Industry Meeting Calendar 10
Editorials 33
Fertilizer Enforcement Problems 34
By Allen B. Lemon
Spray Programs for Fruit Pest Control 36
By A. D. Pickett
Indiana Goes Granular 38
Economical Control of Soil Insects 40
By J. Everett Bussart
Caking in Granular Fertilizer 42
University of Arkansas—Panama, FOA Program 43
By R. P. Bartholomew
The Georgia Agricultural Station 45
By C. C. Murray
Technical Section 46
Fertilizer Consumption in the U. S., 1953-1954 67
By W. E. Scholl and H. M. Wallace
1954 Fungicide Tests (Conclusion) 53
The Listening Post 61
Washington Report 65
Industry News 85
Suppliers' Bulletins 109
Classified Advertising 129
Advertisers' Index 133
Tale Ends 134

AGRICULTURAL CHEMICALS

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Entered as second-class matter November 4, 1949, at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

Why it pays you to sell

aldrin and dieldrin

Intensive national advertising builds top consumer acceptance for these powerful Shell insecticides... helps you sell your own brand!

Powerful timely advertising in magazines, newspapers, on radio and television is telling your customers how they can benefit from a cotton control program with aldrin and dieldrin. This advertising is planned to appear when growers are getting ready to start their control program. You can profit from this heavy advertising support by stocking these powerful Shell insecticides and recommending them to your customers.

Aldrin makes up easily in dusts, or emulsible concentrates for spray application. It provides fast kill—high kill of the major cotton pests. It is compatible with other insecticides such as DDT, parathion and aramite. Recommend that your customers use aldrin for their all-season cotton pest control program.

Dieldrin—aldrin's famous insecticide twin—provides long residual action. It's especially valuable for control in dry, windy areas. Dieldrin, too, is available in dusts or emulsible concentrates.

FOR GRASSHOPPERS

Aldrin and dieldrin are recognized as the Number One grasshopper control both in the United States and abroad. Only a few ounces per acre provide as high as 99% control, regardless of how heavy the intestation.

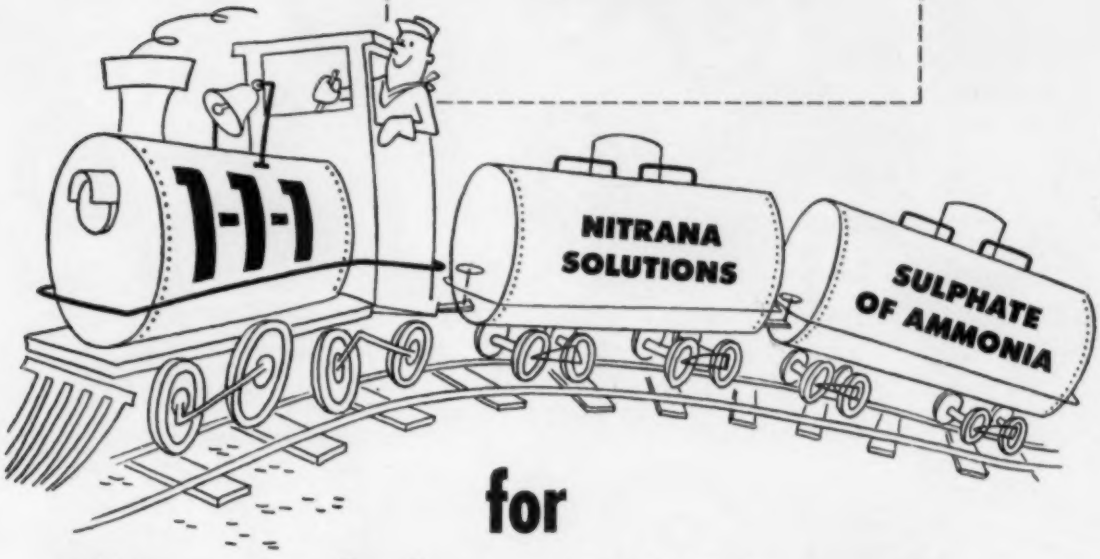
Both aldrin and dieldrin are backed by state and federal labels and recommendations. Start to make extra profits today—stock, display, sell both aldrin and dieldrin!

SHELL CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION

460 Park Avenue, New York 22, New York

On the right track



for Nitrogen balance in 1-1-1 ratios

High-analysis 1-1-1 ratio fertilizers are in fast-growing demand by farmers. The increasing call for 8-8-8, 10-10-10 and 12-12-12 emphasizes the need for a practical means of building nitrate and ammonia nitrogen balance in these popular grades.

ARCADIAN® Nitrogen Solutions and Sulphate of Ammonia turn the trick. This economical combination is all you need to produce 1-1-1 and other ratio mixtures which cure quickly, with better granulation, less dust and better handling qualities. For details on this practical way to better fertilizers for your trade, consult a Nitrogen Division technical service representative. His services are available to customers at no cost.

Arcadian

PRODUCTS FOR PROFITABLE FARMING

Nitrogen Solutions
(NITRANA® and URANA®)

Sulphate of Ammonia

AMERICAN
Nitrate of Soda

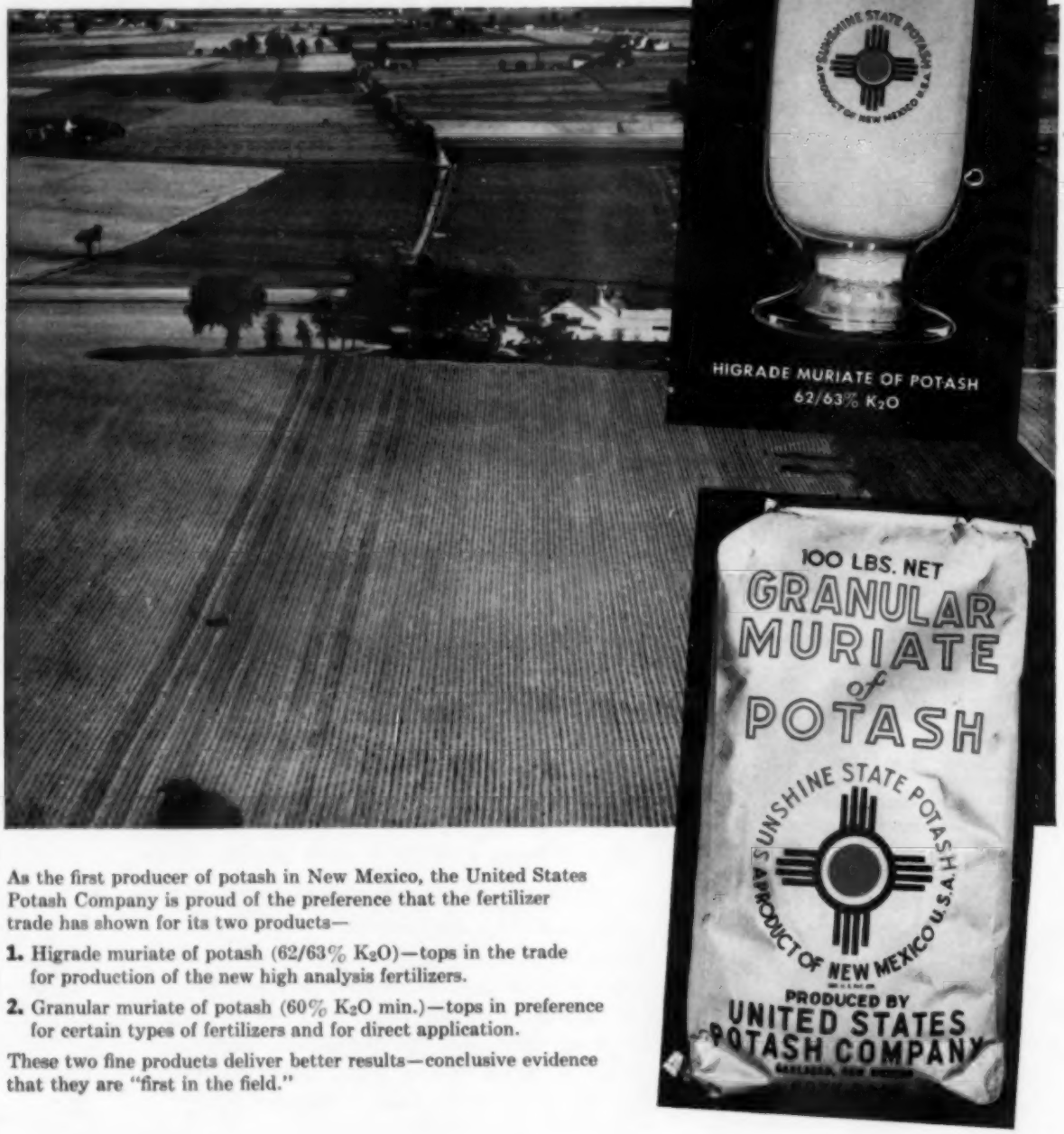
A-N-L®
Nitrogen Fertilizer

Urea Products

NITROGEN DIVISION, Allied Chemical & Dye Corporation
New York 6, N. Y. • Ironton, Ohio • Omaha 7, Neb.
Indianapolis 20, Ind. • Hopewell, Va. • Columbia 1, S. C.
Atlanta 3, Ga. • San Francisco 3, Cal. • Los Angeles 15, Cal.

NITROGEN DIVISION ALLIED CHEMICAL

FIRST IN THE FIELD



As the first producer of potash in New Mexico, the United States Potash Company is proud of the preference that the fertilizer trade has shown for its two products—

1. Higrade muriate of potash (62/63% K_2O)—tops in the trade for production of the new high analysis fertilizers.
2. Granular muriate of potash (60% K_2O min.)—tops in preference for certain types of fertilizers and for direct application.

These two fine products deliver better results—conclusive evidence that they are "first in the field."

UNITED STATES POTASH COMPANY

INCORPORATED

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Southern Sales Office Rhodes-Haverty Building, Atlanta, Georgia

this Advertising Space is FREE!

MULTIPLY THE NUMBER of units shipped throughout the year by the number of "impressions" made in transit from your plant to destinations, and you may place a much higher value on your Multiwall Paper Shipping Sack as a means of advertising your company and products.

And remember, *the advertising space on every sack costs you not one red cent!*

We are helping more and more industries to make the most of this opportunity for advertising and increased sales by the use of our Kolorseal process which reproduces design and copy in clean, bright colors in perfect register.

May the Raymond man show you actual proof? . . . Write or phone . . . It will not obligate you in the least.

THE RAYMOND BAG COMPANY
Middletown, Ohio. Phone 2-5461

Raymond

MULTIWALL PAPER SHIPPING SACKS

Meeting Calendar

June 2 — S. C. Fertilizer Meeting, Sand Hill Experiment Station, near Columbia, S. C.

June 3 — Fertilizer Section, Virginia State Safety Association, Richmond, Va.

June 11 — Executive Committee, Fertilizer Section, National Safety Council, Roanoke Va.,

June 12-15 — National Plant Food Institute Convention (joint meeting of APFC and NFA), The Greenbrier, White Sulphur Springs, West Va.

June 21 — Western Agricultural Chemicals Assn., Hotel Clark, Los Angeles.

June 22-24 — Pacific Slope Branch, E.S.A., Mission Inn, Riverside, Calif.

June 22-24 — 13th Annual Convention of the Association of Southern Seed and Fertilizer Control Officials, Jung Hotel, New Orleans.

June 28-30 — Regional Fertilizer Conference, Pacific Northwest Plant Food Association, Boise Hotel, Boise, Idaho.

July 5-8 — Convention of Plant Food Producers of Eastern Canada, Bigwin Inn, Muskoka, Toronto.

July 21-22—Great Plains Agricultural Ammonia Association, Midwest Trade Show July 21, Hotel Ft. Des Moines for members only. Field Day with Iowa State College, July 22, at Ames Ia. open to public.

Aug. 8-10—North Central Division American Phytopathological Society, Wooster, Ohio.

Aug. 9-11 — Ohio Pesticide Institute Meeting, Wooster, Ohio.

August 10 — Kentucky Fertilizer Conference, Guignol Theatre, University of Kentucky, Lexington

Aug. 15-19 — Annual Meetings, American Society of Agronomy and the Soil Science Society of of America, California College of Agriculture, Davis, Calif.

Aug. 16 — Connecticut Agricultural Experiment Station, Field Day, Mt. Carmel, Conn.

Sept. 7-9—National Agricultural Chemicals Assoc., Annual meeting, Spring Lake, N. J.

Sept. 7-9 — Beltwide Cotton Mechanization Conf., Texas A&M College

Sept. 13-15, Western States Garden Supply Trade Show, Oakland, Calif.

Oct. 17-21 — National Safety Congress & Exposition, Chicago, Ill.

Oct. 18-20 — Canadian Entomological Society of America, Fredericton, B. C.

Oct. 27 — Middle West Soil Improvement Committee, annual business meeting, Sherman Hotel, Chicago.

Nov. 7-8—California Fertilizer Assoc., 32nd annual meeting, Hotel Mark Hopkins, San Francisco.

Nov. 28 - Dec. 1 — Entomological Society of America, Annual Meeting, Netherlands Plaza, Cincinnati.

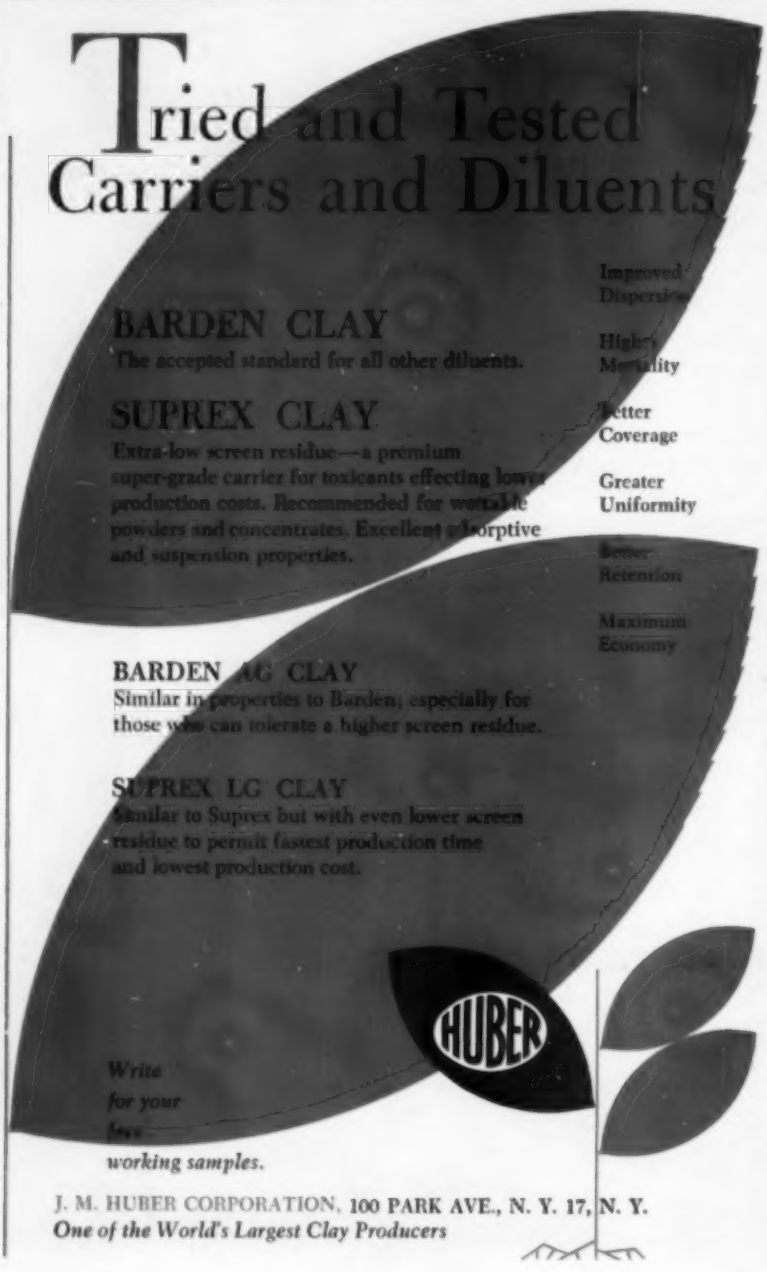
Dec. 5-7 — Agricultural Ammonia Institute, Kansas City, Mo.

Jan. 4-6—Weed Society of America, Hotel New Yorker, New York City.

Jan. 10-11 — North Carolina Pesticide School, Raleigh, N. C.

Jan. 16-18 — N. W. Vegetable Insect Control Conf., Imperial Hotel, Portland, Ore.

Jan. 18-20 — Western Cooperative Spray Project, Imperial Hotel, Portland, Ore.


Tried and Tested
Carriers and Diluents
BARDEN CLAY
The accepted standard for all other diluents.
SUPREX CLAY
Extra-low screen residue—a premium super-grade carrier for toxicants effecting lower production costs. Recommended for wettable powders and concentrates. Excellent adsorptive and suspension properties.
Improved Dispersion
Higher Mobility
Better Coverage
Greater Uniformity
Better Retention
Maximum Economy
BARDEN AG CLAY
Similar in properties to Barden, especially for those who can tolerate a higher screen residue.
SUPREX LG CLAY
Similar to Suprex but with even lower screen residue to permit fastest production time and lowest production cost.
HUBER
Write for your free working samples.
J. M. HUBER CORPORATION, 100 PARK AVE., N. Y. 17, N. Y.
One of the World's Largest Clay Producers

your eye tells you why

International's New Triple Superphosphate Means

better granulation

YOUR first glance tells you why the fine, virtually dust-free texture of International's new Triple Superphosphate gives such improved results. It promotes better granulation in your high analysis plant foods — improves product acceptance. It assures thorough and more complete ammoniation; reduces the need to grind before mixing; cuts mixing costs. Proper conditioning before shipment also reduces the problem of setting up en route, for easier, more economical handling — plus high product performance.

International's new Triple Super offers these extra benefits because it's produced by a new process from high quality rock. Result: a high analysis product (46% A.P.A. or better) with the right particle size and correct chemicals structure for best results in making modern plant foods. International's expanded facilities assure a reliable supply of this improved Triple Superphosphate, now available for immediate delivery to your plant. Write or wire the Phosphate Chemicals Division for samples and quotations.

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

The Nation's Largest Producer of Phosphates • *General Offices: 20 North Wacker Drive, Chicago 6*

DESTROY WEEDS

this low-cost thrifty way

POLYBOR-CHLORATE®
WEED KILLER
FOR SPRAY APPLICATION

here's the Weed Killer with effective **DOUBLE ACTION**

Polybor-Chlorate destroys weeds and grasses *on contact* and through *root action* . . . then residual action continues, to prevent regrowth. This is one weed killer than can destroy *all* vegetation quickly and easily when applied properly! Polybor-Chlorate is so highly soluble that continued agitation of spray equipment is unnecessary. This herbicide combines the effective plant-destroying powers of sodium borates and sodium chlorate; it is non fire-hazardous! Polybor-Chlorate is a labor saver and a money saver . . . one spraying may suffice to keep the treated area bare of growth for a year or more!

YOU CAN DESTROY ALL OF THESE WEEDS and GRASSES . . . EASILY

BINDWEED (Wild Morning-glory) ✻
QUACKGRASS ✻ CANADA THISTLE ✻
WHITETOP (Hoary Cress) ✻
ST. JOHNSWORT ✻ LEAFY SPURGE ✻
POISON OAK ✻ POISON IVY ✻
NUTGRASS ✻ BERMUDA GRASS ✻
JOHNSON GRASS ✻
. . . and many, many others!

NO FIRE HAZARD

FAST-ACTING
APPLY WET OR DRY
ECONOMICAL
NONSELECTIVE

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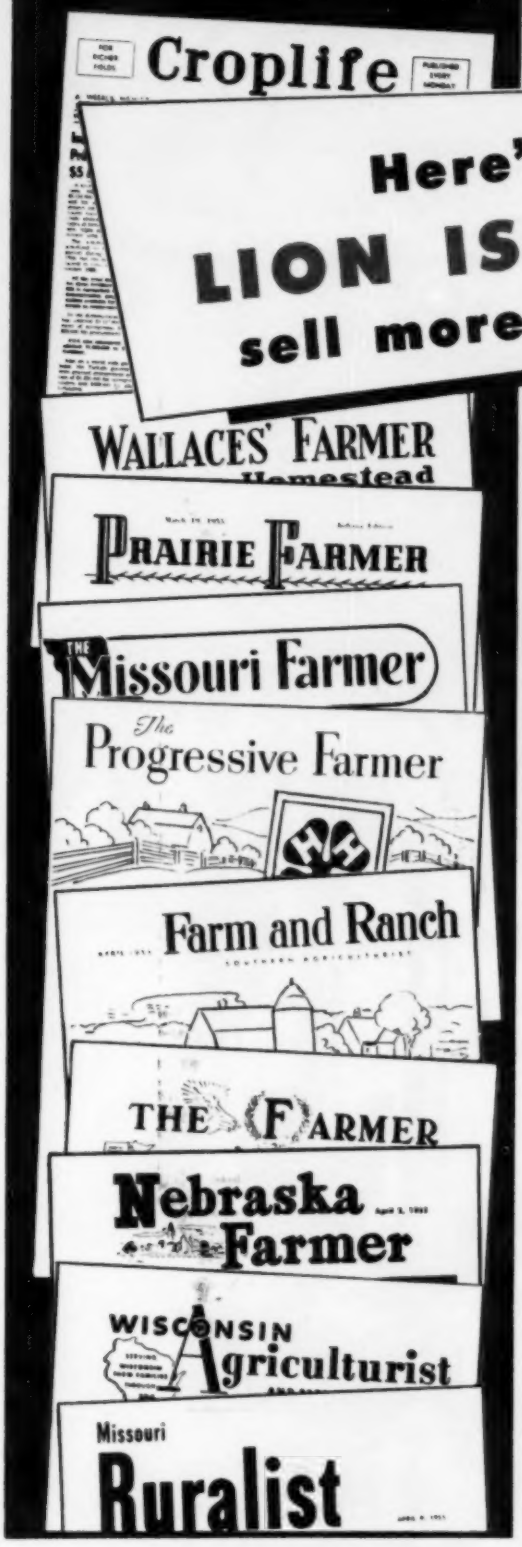
DIVISION OF BORAX CONSOLIDATED, LIMITED
630 SHATTO PLACE, LOS ANGELES 5, CALIFORNIA

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS



Here's another way
LION IS HELPING YOU
sell more Nitrogen Fertilizer

Impressive, Big-Space Advertisements are Appearing Month-After-Month in all These Publications

Lion's Chemical Sales Division is working to make sure you, as a fertilizer mixer, sell more fertilizers. One way we help is by consistent advertising to dealers and farmers. This advertising emphasizes how plant foods can best serve the farmer by increasing his profits.

We also offer One-Stop Service—which means you can contract for your nitrogen requirements from a single dependable source, saving you time (which, these days, is money!). As for *quality*, you can build your own reputation on a solid basis when you depend on Lion quality.

And when you need assistance with a formulation problem, our skilled Lion technical staff is ready to help you.

Our great storage facilities and the variety and flexibility of our manufacturing operations assure you of prompt shipment.

LION—A LEADER IN PETRO-CHEMICALS OFFERS:

Lion Anhydrous Ammonia—For formulation. A uniformly high-quality basic product. Nitrogen content, 82.2%.

Lion Aqua Ammonia—For formulation or acid oxidation. Ammonia content about 30%. Other grades to suit you.

Lion Ammonium Nitrate Fertilizer—For formulation or direct application. Improved spherical pellets. Guaranteed 33.5% nitrogen. Flows freely, spreads evenly.

Lion Nitrogen Fertilizer Solutions—For formulation. Three types to suit varying weather and manufacturing conditions.

Lion Sulphate of Ammonia—For formulation or direct application. Uniform, free-flowing crystals. Guaranteed to contain a minimum of 21% nitrogen.

DISTRICT SALES OFFICES:

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WORLD'S LARGEST MANUFACTURER OF PRILLED AMMONIUM NITRATE

LION OIL COMPANY

CHEMICAL SALES DIVISION

EL DORADO, ARKANSAS

LION

Blended Field Strength Insecticides

...produced in One operation

with the Raymond Whizzer IMP MILL

THIS clean dustless system does a wonderful job in the superfine grinding and thorough blending of all modern types of insecticide formulations — such as DDT, BHC, Toxaphene and Chlordane.

The Imp Mill handles the material automatically from feed hopper to finish bin. The action of Whizzer air separation insures an intimate mixture and a uniformly classified product. The cooling effect of air separation also permits longer runs because of lower mill temperatures.

Raymond Mills have won wide acceptance in the insecticide industry due to their operating advantages — their low cost installation, operation and maintenance — and dependable service.

For complete details, write for Bulletin #68

RAYMOND IMP MILL equipped with Whizzer Air Separator

COMBUSTION ENGINEERING, INC.

1314 NORTH BRANCH ST.
CHICAGO 22, ILLINOIS

Raymond Division

SALES OFFICES IN PRINCIPAL CITIES

TRIPLE SUPERPHOSPHATE

1. RUN-OF-PILE FOR MAXIMUM AMMONIATION
2. GRANULAR FOR DIRECT APPLICATION
3. PROMPT SERVICE TO MEET EVERY REQUIREMENT

The source of superior phosphate fertilizers for nearly 30 years, U. S. Phosphoric Products is your ideal source for quality and dependability in Triple Superphosphate. Your Bradley & Baker sales representative will be glad to help you plan your shipments for maximum satisfaction. *Call upon him today.*

U.S. PHOSPHORIC PRODUCTS
Division TENNESSEE CORPORATION
Tampa, Florida

TC
TENNESSEE CORPORATION

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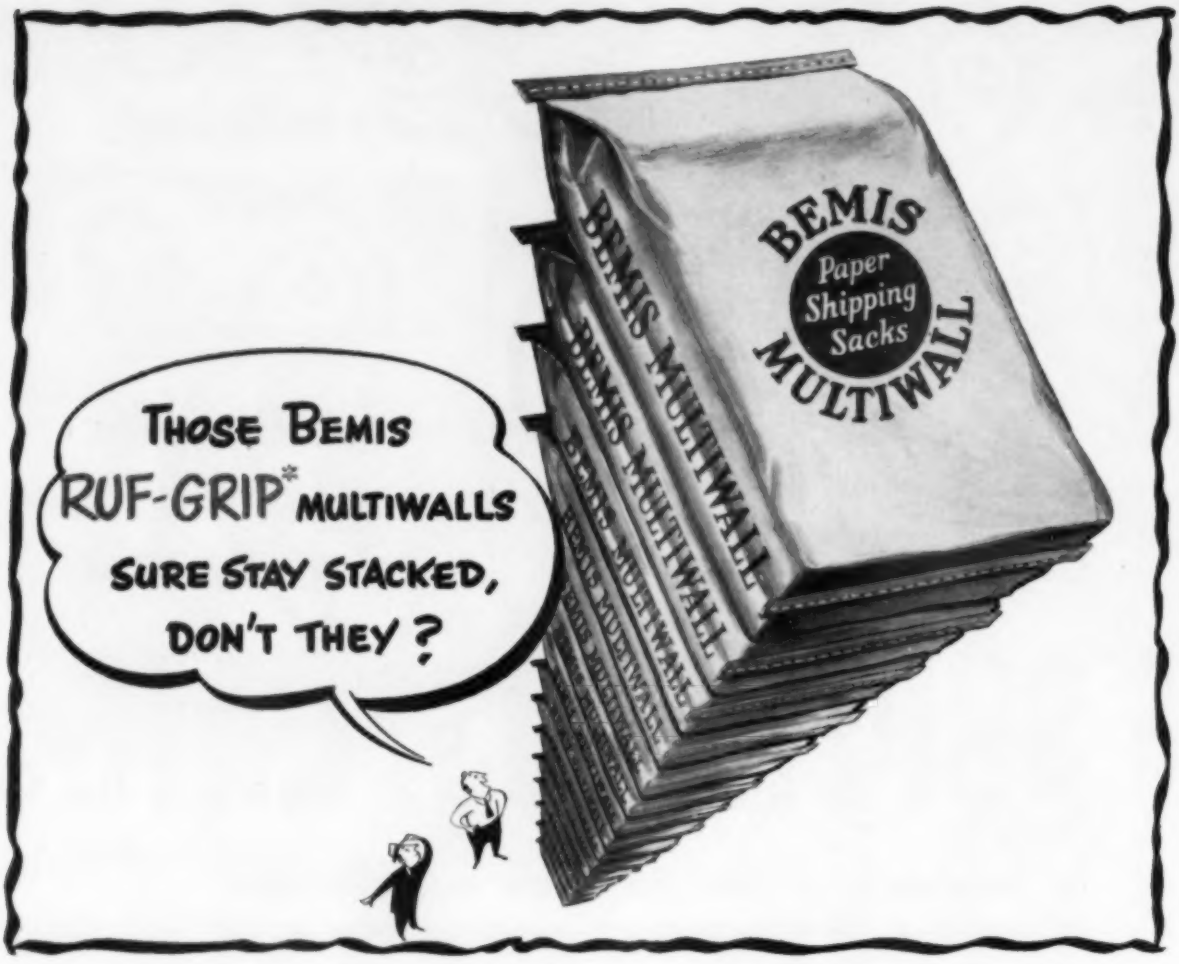
HOUSTON



Bemis Multiwalls made with RUF-GRIP kraft handle easily...and stack easily... and stay stacked. Consequently, they ship and store better. Get the details from your Bemis Man.

*TRADE-MARK

Also in the Bemis Family, Serving the Fertilizer Industry...

Burlap Bags

Cotton Bags

Waterproof (Laminated) Bags

Bemis

General Offices—St. Louis 2, Mo.
Sales Offices in Principal Cities

BEMIS BRO BAG CO.

(Photo — Courtesy Soil Conservation Service, U. S. D. A.)

High Grade Muriate of Potash

by DUVAL

Duval Muriate of Potash ranks high as one of the essential nutrients which greatly increase yield and profits in crop production.

DUVAL SULPHUR and POTASH CO.
Modern Plant and Refinery at Carlsbad, New Mexico

Address all communications to:
ASHCRAFT-WILKINSON CO.
Exclusive Distributors
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NORFOLK, VA. • CHARLESTON, S. C. • TAMPA, FLA. • JACKSON, MISS. • COLUMBUS, OHIO • DES MOINES, IOWA

NEWS Brevities

L. C. OAKLEY, JR., has been named general manager of the U. S. Phosphoric Products Div. of Tennessee Corp. Atlanta, Ga.

* * *

RAY I. MITCHELL has been named sales manager of Vulcan Steel Container Co., Birmingham, Ala.

CHEMICAL SERVICE CORP., New York, is continuing its expansion program with addition of space and facilities at its present locaton.

* * *

R. J. MCDONALD, sugar bag sales manager for Bemis Bro. Bag Co., Denver, has been appointed sales manager for the company's packaging service department in Minneapolis, effective July 15.

* * *

FULTON BAG & COTTON MILLS, New Orleans, announced recently that Harry Kantzar, Jr. has joined their Denver office as sales representative.

* * *

GONZALES CHEMICAL INDUSTRIES, Inc, San Juan, Puerto Rico, will build a $12,250,000 anhydrous ammonia plant in Puerto Rico.

* * *

ST. PAUL AMMONIA PRODUCTS, Inc., began construction of a $15 million ammonia plant at Pine Bend, Minn. The new installation will have a capacity of 200 tons of ammonia a day.

* * *

DEVELOPMENT OF SR 406 ("Captan") by Allen R. Kittleson, Esso Research and Engineering Co., New York, was described for the public in the May issue of *Coronet* magazine.

* * *

GRACE CHEMICAL CO., which recently moved its company headquarters from New York to Memphis, has announced establishment of a new division known as the Grace Chemical Research and Development Co. division.

* * *

F. G. BEMIS, president of Bemis Bro. Bag Co., Boston, has been re-elected a board member of the National Industrial Conference Board.

* * *

WILLIAM GRACE HOLLOWAY, chairman of the board of directors W. R. Grace & Co., announced his retirement last month at the company's annual meeting of stockholders.

* * *

THE AMERICAN POTASH INSTITUTE announced recently that a total of 1,144,305 tons of potash salts containing an equivalent of 674,174 tons of potassium oxide were delivered during the first quarter of 1955 by the seven major American producers.

A complete series of aromatic petroleum naphthas, coal tar naphthas, heavy naphthas, coal tar heavy naphthas, solvent oils and heavy oils. Each solvent is carefully fractionated so that product specifications are closely maintained.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.
Clairton, Pennsylvania
Plants at
Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.
District Sales Offices
New York, Chicago, Philadelphia, Pittsburgh, Detroit

Pennsylvania Industrial Chemical Corp.
Clairton, Pennsylvania
Please send me a copy of your bulletin describing Picco Solvents and Solvent Oils for (application)_____
Name_____ Position_____
Company_____
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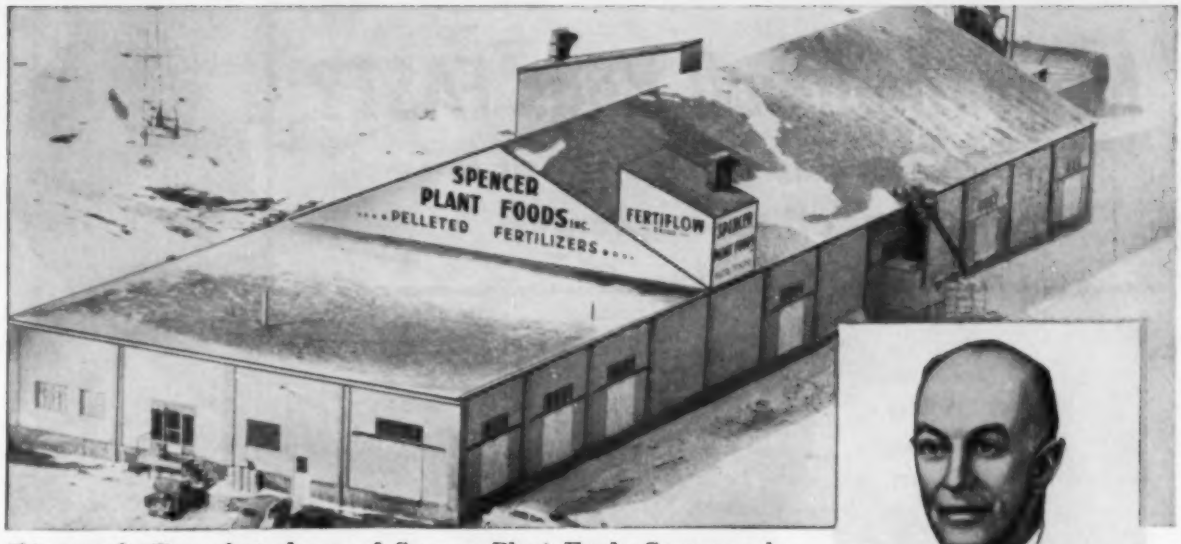
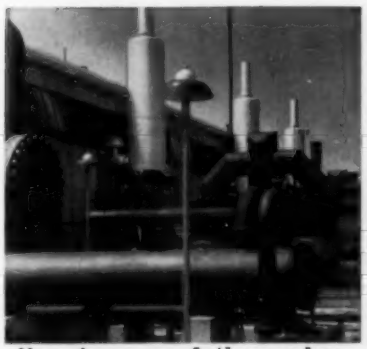


This new fertilizer plant, home of Spencer Plant Foods Company, is located one mile north of Spencer, Iowa. The plant, with a capacity of 25,000 tons, has walls and floors of poured concrete. Production is a 100% Granular product made in a Blue Valley Fertilizer Granulator.

Spencer Plant Foods Co.

. . . Another Spensol User

Fred Sherer (above) is president of Spencer Plant Foods Company. Bob Cloud is production superintendent and Frank Powers is sales manager.



Here is some of the modern equipment used by Spencer to produce SPENSOL Nitrogen Solutions for some of America's leading fertilizer mixers.

On time deliveries of SPENSOL solutions have helped to build Spencer's reputation for dependable service to mixers throughout the country.

New kind of solution injector, giving better ammoniation of mixed fertilizer, was invented by H. B. Davis of Spencer Chemical Company staff.

SPENCER

SPENCER CHEMICAL COMPANY, Dwight Bldg., Kansas City 5, Mo. District Sales Offices: Atlanta, Ga.; Chicago, Ill.; Memphis, Tenn.; Works: Pittsburg, Kans.; Henderson, Ky.; Chicago, Ill.; Vicksburg, Miss.; Orange, Texas.

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All Fulton plants are equipped to imprint multiwall paper bags with your brand.

Whatever type of bag you need — Fulton serves you better

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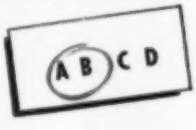
Burlap mills are classified A, B, C, and D. Fulton buys *only* from AB mills, to be sure your finished bags are *never* made from burlap with hidden weakness.



Note: You can get regular burlap — and Ful-Brite, the brighter burlap — from Fulton. Ful-Brite is a prestige package for your premium products.

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From the raw cotton to the finished bag, Fulton guards quality. Weight and weave of every fabric are tested to assure uniformity in all bags.

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THIS symbol stands for high-grade coarse and uniform Muriate of Potash (60% K_2O minimum). Southwest Potash Corporation provides a dependable supply of HIGH-K* Muriate for the plant food industry.

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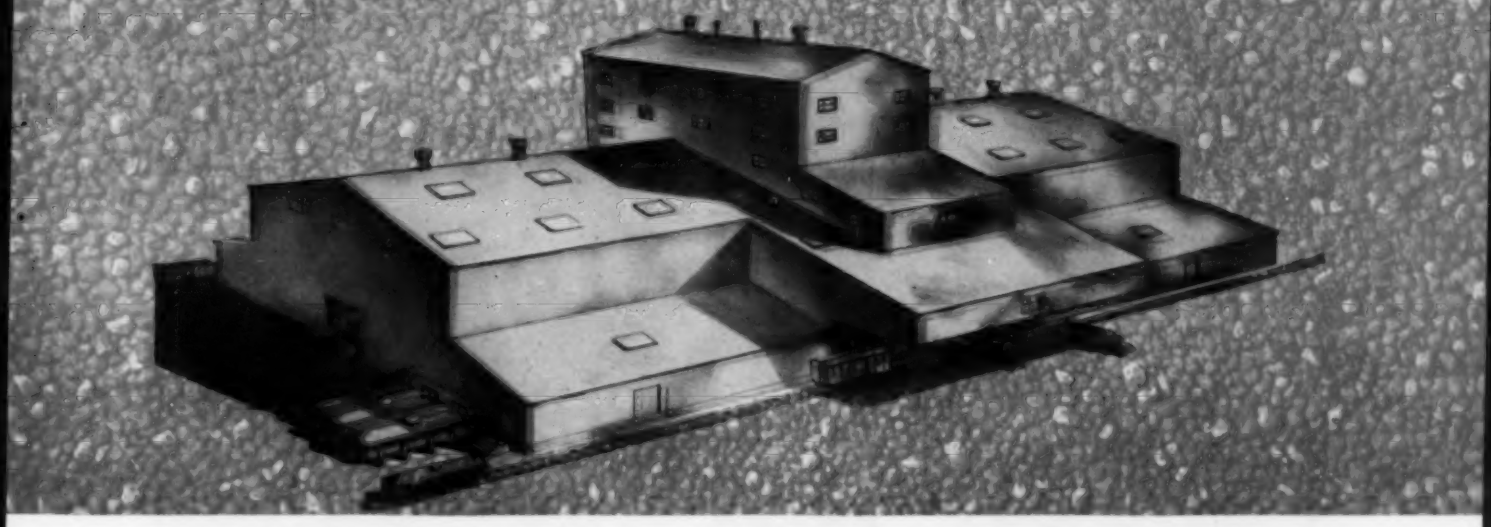

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Solving any puzzle is more easily achieved if key parts can be determined. As a carrier and diluent for insecticides, fungicides, sprays and dusts, Diluex and Diluex A exceed the most exacting qualifications of the agricultural chemical formulators.

Diluex and Diluex A are basically an aluminum magnesium silicate mineral, having an amphibole-like structure possessing a large adsorption capacity in liquid impregnation procedures used in processing the newer complex organic insecticides. Both products are widely accepted as superior grinding or milling aids for technical grade toxicants such as DDT and BHC and will discharge readily from commercial dust applicators giving uniform coverage and minimum fractionation of toxicant and carrier in the swath.

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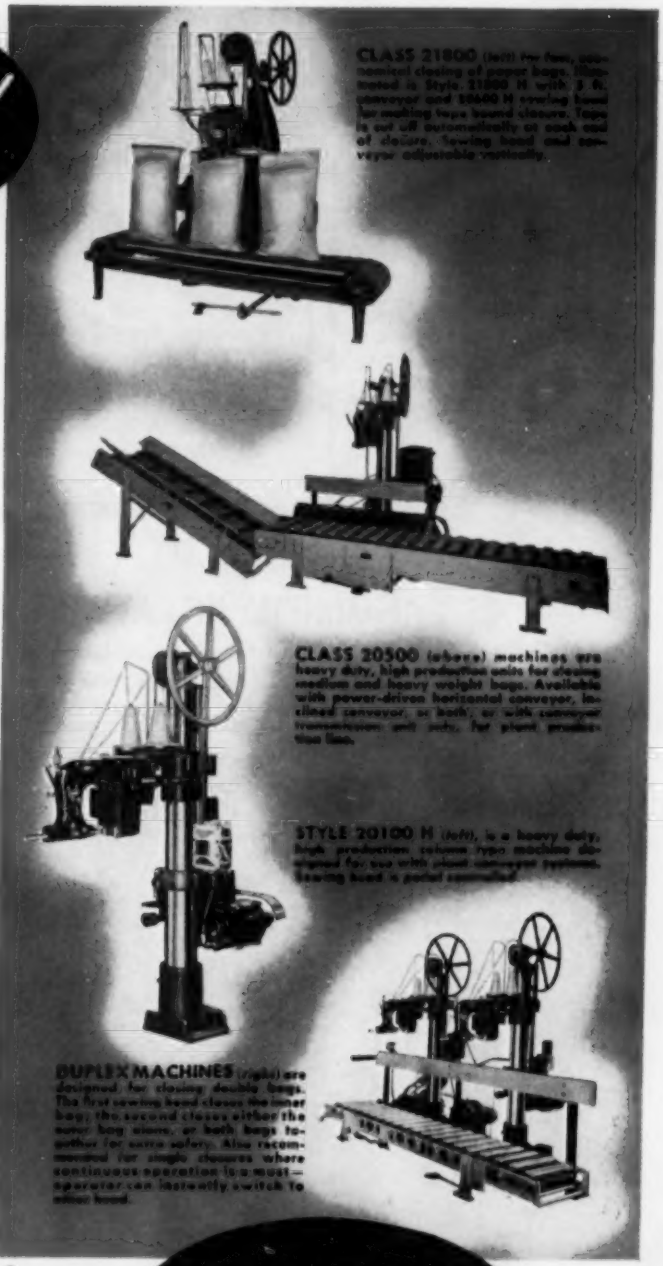
Coupled with a complete line of equipment is Union Special's vast background of experience and technical know-how that insures customers of getting THE RIGHT MACHINE FOR THE JOB!

Union Special representatives located in all leading industrial centers are qualified by experience and training to give you expert recommendations. Take advantage of the service they offer.

Ask for recommendations. UNION SPECIAL MACHINE CO., 447 North Franklin St., Chicago 10, Illinois.

Send for Bulletin 200



CLASS 21800 (left) two-feed, post-needle closing of paper bags. Illustrated is Style 21800 H with 3 ft. conveyor and 20600 H sewing head for sealing tape bound closure. Tape is cut off automatically on each end of closure. Sewing head and conveyor adjustable vertically.

CLASS 20500 (above) machines are heavy duty, high production units for closing medium and heavy weight bags. Available with power-driven horizontal conveyor, inclined conveyor, or both; or with conveyor transmission unit only, for plant production line.

STYLE 20100 H (left), is a heavy duty, high production, column type machine designed for use with plant conveyor systems. Sewing head is pedal controlled.

DUPLEX MACHINES (right) are designed for closing double bags. The first sewing head closes the inner bag; the second closes either the outer bag alone, or both bags together for extra safety. Also recommended for single closures where continuous operation is a must—operator can instantly switch to other head.

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BAG CLOSING MACHINES

MORE PRODUCTION WITH LESS EFFORT!

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ANHYDROUS AMMONIA
82.3% N

The most economical and concentrated source of nitrogen available as a plant food. As a fertilizer it is applied directly to the soil and through irrigation. It is widely used by the fertilizer manufacturer for ammoniating superphosphates and as a basic source of N in combined plant-food forms.

AQUA AMMONIA

Convenient form of nitrogen for high-analysis formulations and acid oxidation. Nitrogen content approx. 20% in most widely used grade. Various concentrations available to suit your special need.

NITROGEN SOLUTIONS
CSC 101 – 40.6% N
CSC 102 – 40.8% N
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Nitrogen solutions provide the lowest cost and most efficient media for quick curing of superphosphates. They supply more total N than any other ammoniating media. CSC Nitrogen Solutions offer the fertilizer manufacturer a wide range of physical properties to meet all requirements.

CSC AMMONIUM NITRATE FERTILIZER 33.5% N

New, crystalline form made by CSC's exclusive process. New process assures low moisture, free flow, and excellent handling and storage characteristics. CSC Ammonium Nitrate Fertilizer is going to the farmer through leading fertilizer manufacturers.

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EASY TO APPLY . . . EASY TO SELL

Phosphatic Fertilizer Solution

California Formulator Blends Monsanto's Solution with Aqua Ammonia to Make Neutral 8-24-0 for Direct Application

Mounted behind cutting blades for protection, slender hoses carry liquid 8-24-0 from tank into soil as fast as it is broken.

Side-dressing eight rows of carrots at a time is simple chore for this rig. Note twin tractor-mounted tanks for carrying 8-24-0 used by this fertilizing contractor. Formulator also sells direct to farmer, and does fertilizing on contract.

Fertilizer tank follows wide-spread drill rig. Set-up is particularly well suited to preplanting fertilization which may take place in either spring or fall in Sacramento-Imperial Valley-San Joaquin area where much of the 8-24-0 is sold.

New-type liquid fertilizer drill and tank arrangement gets trial. Formulator maintains sizable test area for trying out new liquid fertilizer applicators, and to observe results of various liquid fertilizer formulations on crop response.

Giant drill rig covers a lot of ground fast, gets through matted surface of field to inject 8-24-0 into root zone. Side mounting of these fertilizer tanks makes it possible to carry a full day's supply without delays for refilling.

8-24-0 is used on all varieties of crops. Here's a set-up that's ideal for applying it in close row work. The large fertilizer tank is mounted out of the way in the rear. Fertilizer drills located in front help driver guide tractor.

Photographs courtesy Bros Chemicals, Inc.

Formulator's customers don't need potash, so company makes 8-24-0. If your trade calls for a complete soluble fertilizer, Monsanto has the right ingredients:

Diammonium Phosphate	(21.0-53.8-00.0)
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These compounds are highly concentrated—cost you less to store and handle. They're pure—give you extremely close control of formulation. And—your supply is assured by Monsanto, world's largest producer of elemental phosphorus. Write now for booklet "Concentrated Water Soluble Fertilizers" to MONSANTO CHEMICAL CO., Inorganic Chemicals Division, 710 N. 12th Boulevard, St. Louis 1, Missouri.

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CHEMICALS - PLASTICS

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PROFIT STIMULANT FOR THE SOIL

Turning farm products into profits calls for more than modern farm machinery. Today's production booster that adds a bonus of better quality to almost any crop is anhydrous ammonia. It's the newest member of the Atlantic family of petrochemicals . . . that's why you see a miniature refinery superimposed on the field of growing corn.

This ammonia gas is injected into the soil where it provides low-cost nitrogen for plant growth.

Farmers well know that corn, like most crops, takes great quantities of nitrogen from the soil. Anhydrous ammonia acts as a fountain of youth. It gives the soil plenty of nitrogen for high crop yields at minimum cost per acre. In addition, anhydrous ammonia is used in the manufacture of many dry fertilizers.

Perhaps you're not a farmer. Practically all of us, however, benefit from anhydrous ammonia. It is used in widely different industrial products such as synthetic fibers, plastics and explosives.

Industry of all kinds is constantly finding new and profitable uses for Atlantic petrochemicals. Atlantic engineers will gladly work with your technical staff to help reduce costs, improve quality, increase production or develop new and better products through the use of these chemicals. For information on this service, write to The Atlantic Refining Company, Dept. J-6, Chemical Products Sales, 260 South Broad Street, Philadelphia 1, Pa.

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In the West: *L. H. Butcher Co.*

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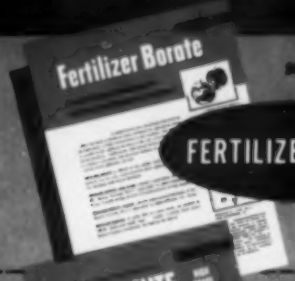
of interest to everyone connected in any way with improving agriculture.

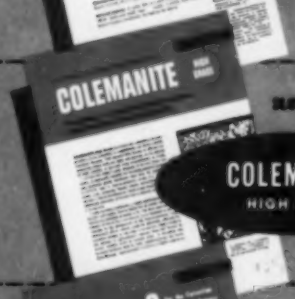
3 TYPES OF BORATES... TO CORRECT AND PREVENT BORON DEFICIENCY!



SOLUBLE

FERTILIZER BORATE

A sodium borate ore concentrate rich in boron—offers the most economical source of boron for agriculture. This material is suitable for BORATING fertilizers or for use as dry application direct to soil. Fertilizer Borate is offered in two grades with choice of coarse or fine mesh. High Grade contains 44% B_2O_3, Regular contains 34% B_2O_3. Send for Bulletin PF-3.



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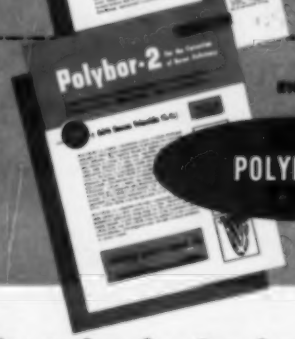
HIGH GRADE

A natural calcium borate mineral. This slowly soluble lime borate is offered for conditions where soils are light and porous, or in regions of high rainfall. The slow and extended release of available boron by Colemanite as it weathers is advantageous to cotton and boron-sensitive crops which do require boron. Content in B_2O_3 ranges from 32% to 35%. Send for Bulletin PF-2.



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Contains a higher percentage of available boron than any comparable agricultural borate on the market . . . 20.5% Boron or 66% B_2O_3. This material should be applied as a spray or dust, directly to the foliage of crops. Polybor-2 is compatible with insecticides and fungicides currently in use and may be applied in the same solutions in the established routine culture of crops. Send for Bulletin PF-4.

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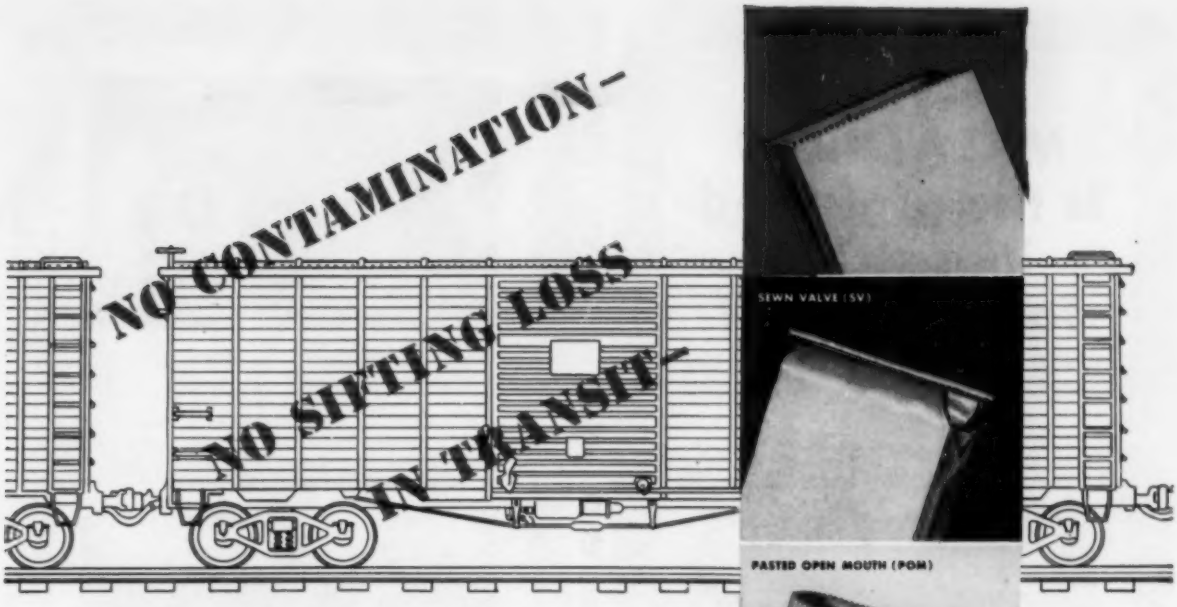

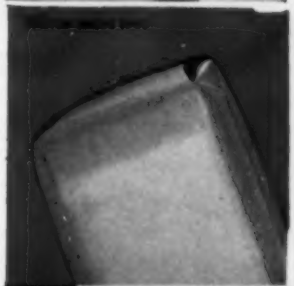

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Why MALATHION is the preferred insecticide for fly control

Applying malathion in dairy barn

Malathion kills flies, fly maggots in manure piles

Spraying hog lot with malathion

There are many good reasons why malathion is so successful as a fly control insecticide, and why it is attracting so many new users. Here are the most important:

Malathion is amazingly effective

- quick-acting
- with a long residual kill (up to 21 days, depending on local conditions)
- kills DDT-resistant flies and fly maggots, too

Malathion is easy to use

- as a knockdown or residual spray made from wettable powder or emulsifiable liquid
- as a dry bait

Malathion is economical

- low in cost
- gives maximum fly control for every dollar spent

Malathion is versatile

- can be applied in and around dairy barns and other buildings housing farm animals
- on manure piles, garbage heaps, along fence rows, around water troughs
- around meat-processing establishments
- around the home . . . porches, patios, breezeways, garbage pails

Malathion is recommended for fly control by USDA.

Dealers and Distributors . . . Sales of malathion insecticides, for fly control and for other purposes, are booming. If you are not already stocking and selling these profitable insecticides, *do so now!* Malathion insecticides are available from many well-known manufacturers, under their own brand names. Consult your regular sources of supply, or write us for further information.

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CYANOGAS® Calcium Cyanide Fumigants
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POTASSIUM CYANATE Weedkiller for Agriculture and Turf

Editorial
COMMENTS

THE preliminary convention of the National Plant Food Institute in June will mark the culmination of many months of far-sighted efforts by a group of industry leaders in bringing together the two fertilizer trade associations.

The consolidation of the associations in July is a logical move with obvious and immediate advantages to the industry. Benefits will include economy, the establishment of a single voice for the industry, more effective relationships with the land-grant colleges and others dependent upon the benefits of the plant food industry and its products. Then, too, duplication of effort will be eliminated and more effective projects and programs can be established to mutual advantage.

Many other trade associations profitably could follow the logic represented in the consolidation of The National Fertilizer Association and the American Plant Food Council into a stronger organization that better can tell their story and emphasize the importance of their products in the national economy.

The fertilizer industry has subordinated pride of organization names to getting the job done for its members. Thus, as the fertilizer industry unites in one strong and forceful organization, those who have made the consolidation possible can point with pride to their successful efforts—efforts that will mean a stronger voice, more effective programs, and a brighter future for manufacturers of fertilizers, the producers of plant food materials, and the agricultural education and research forces with whom the industry has a community of interest in building a more successful future for farmers.

AN interesting double-barrelled prediction as to the future of the agricultural insecticide business was made last month by Dr. Clyde Smith in an address to members of the new Carolinas-Virginia Pesticide Formulators Association. Dr. Smith suggested that in ten years the market for insecticides in his state of North Carolina can readily be doubled. He sees possibilities for a big expansion in insecticide sales to a number of markets,—notably in the control of soil insects, forage crop pests and in the protection of our forests from insect attack.

However, as noted above, his prediction is a two-part preview of the future. The second half of the prediction voices the ominous suggestion that many who are now active in the manufacture of insecticides will be out of the business before this anticipated market expansion arrives.

We can add a little prediction of our own to that of Dr. Smith . . . the faces that may be missing 10 years from now will be those of the folks who ignore the potential new markets, and keep looking stubbornly for the return of the halcyon days of '50-'51. They will be the operators quick with the price cut, who are unwilling to pass up business on which they can't make a profit.

And one further prediction,—they won't be missed.

FERTILIZER

IN recent years, sales of commercial fertilizers have increased until the fertilizer business has become an important factor in the national chemical business. Approximately one-quarter of the fertilizer tonnage sold in California, for example, is shipped into the State in the form in which it is sold. Many national advertising campaigns are being carried on to sell commercial fertilizers to the home and garden user as well as to the farmer. There has been some interest shown in establishment of a national fertilizer law similar to that which regulates the sale of pesticides shipped in interstate commerce. Such a law could serve as a uniform pattern for labeling purposes. On the other hand, it has been argued that the present state laws do an adequate job, protecting the public without the added expense of an over-riding national enforcement agency.

One of the big problems has been the variation in requirements of the various state laws and the difficulties that manufacturers have met when they attempted to make a single label that could be used in all states.

The Association of American Fertilizer Control Officials was formed for the purpose of promoting uniform and effective legislation, definitions, rulings, and enforcement of laws relating to the control of sale and distribution of fertilizers. This organization has drafted a so-called model bill which has been adopted by some states. If its general provisions were adopted uniformly by all states, many of the difficulties hampering firms attempting to ship fertilizers throughout the country would be solved, and also many of the problems of the control officials would become easier.

In reviewing the model bill as well as the laws of the various states, it seems obvious that one of the first questions that needs to be settled is the definition of what is a fertilizer. California law is broad in its scope and applies to any substance or mixture of substances intended to be used for promoting or stimulating the growth of plants, increasing the productiveness of plants, improving the quality of crops, or producing any chemical or physical change in the soil. The various substances are subdivided into definitions, with *commercial fertilizers:* those materials containing 5% or more of nitrogen, available phosphorus pentoxide, or potassium oxide soluble in distilled water singly or collectively. *Agricultural minerals* are mineral substances, and mixtures of mineral and organic substances containing less than 5% of these three major plant foods, except sand or soil. The third class of material defined is *manures* and the fourth is *auxiliary plant chemicals,* which are substances such as hormones, auxins, materials for reducing preharvest drop of fruit, materials for promoting rooting of cuttings, bacterial inoculants, and similar products intended for use in influencing plants. The fifth and final subdivision is *soil amendments,* which are all fertilizing materials not previously included.

This classification is somewhat different from that in the model law, which provides that the term "fertilizer material" means any substance containing nitrogen, phosphoric acid, potash, or any recognized plant food element or compound which is used primarily for its plant content, or for compounding mixed fertilizers, except unmanipulated animal and vegetable manures. This definition somewhat overlaps the definition of commercial fertilizers and agricultural minerals as listed in the California law. Apparently it includes compounds containing zinc, iron, manganese, copper, molybdenum, and boron, but does not include gypsum and lime which are intended mainly for soil correction, although it might be argued that magnesium, calcium, and sulfur are actually included. If the definition were expanded and all the elements recognized as valuable for plant food content enumerated in the definition, we would have a good basis to answer the question, "what is fertilizer?"

In addition to specified plant food constituents which should be recognized as fertilizers, a law should specify the minimum quantities that are recognized as being of sufficient quantity to be worth claiming. In order to avoid misrepresentation that mere traces of zinc, iron, manganese, and copper impurities in materials are of economic value, a California regulation specifies that there must be a minimum of 0.1% of these constituents to be worth claiming. There is no objection to a lesser amount being in a product but no claim can be made for it, orally, on the label, or in advertising. Through the years, this regulation has helped to prevent misrepresentation by promoters who wish to make extravagant claims for materials that were either ground rocks, or the remains from old mine dumps.

The various state laws have various labeling requirements, many of which have grown up to take care of particular problems in a special area of the country. Most states require only total nitrogen to be stated, but some require that the water-soluble be distinguished from the

ENFORCEMENT PROBLEMS

By Allen B. Lemmon
Chief, Bureau of Chemistry
California State Dept. of Agriculture

water-insoluble nitrogen, and California regulations provide for separate statement of the percentages of nitric nitrogen, ammonia nitrogen, and organic nitrogen with the derivation stated for the organic nitrogen. Nitrogen from urea or from calcium cyanamide is classed as organic nitrogen, but the label must show the material from which it is derived.

The practice of guaranteeing available phosphoric acid and water-soluble potash is uniform, but most interested persons are in agreement that eventually this must be changed to the elemental basis of phosphorus and potassium, as the present terminology is certainly confusing.

There are many variations with regard to the constituents that may be claimed in a fertilizer. Most states, such as California, require a statement on the element basis with a derivation, while Florida requires the guarantee to be given in terms of oxides and some have been requiring it in terms of pounds of the basic material used; for example, so many pounds of borax per ton. As long as a fertilizer business operates within a local area without crossing state lines, these variations do not have much significance, but when a manufacturer wishes to ship throughout the country, he is in difficulty.

Many states restrict the number of grades of mixed fertilizer that may be sold, and there is little agreement on a national basis. California has no such restriction, and over 600 grades are marketed each year. Two grades, 10-10-5 and 8-8-4, which both provide the ratio 2:2:1, made up one-fifth of the tonnage. These two, with 17-7-0, made up one-third of the tonnage. The top eight grades made up one-half of the tonnage of dry mixed fertilizers. Many of the other grades were single orders of a few tons.

Few laws agree on the shortage of per cent that constitutes a deficiency or violation of law. This makes it difficult to compare the record of the firms in different states. Apparently many deficiencies are caused by segregation. The use of the higher-analysis products in making fertilizers of very high grades has resulted in segregation of constituents when simple mixing of high-analysis components was done. In order to secure a uniform mixture that does not segregate, many firms have found it necessary to install expensive mixing equipment with special pelleting devices so that the high-analysis fertilizers will be uniform.

Another problem that has developed is the proper labeling of large size containers of liquid fertilizers. It is a simple matter in many cases to dilute liquid fertilizers with water without the purchaser realizing that he is receiving a diluted material. To guard against this, the fertilizer control official must have some way to take prompt and effective action against anyone practicing such fraud. One important aid in preventing such fraud is to have a legal requirement that fertilizers must be sold in a lot labeled by a registrant or a package filled and labeled by a registrant. Registration can then be suspended or revoked if a firm is found selling fertilizers without proper label or of a composition different from that stated on the label.

This same principle applies not only to large size tanks of fertilizers sold to farmers but also to the so-called lawn services, which in some cases are fuel oil trucks during part of the year and fertilizer lawn servicing equipment during another part of the year. In these operations, the firm should be a registrant, each truck properly labeled with the composition of the material in it, and a copy of the label information left with each home owner whose lawn has had the fertilizer applied to it. Probably one of the best ways to measure the quantity applied is through a meter and the delivery ticket handed the home owner should show not

(*Continued on Page 125*)

Modified Spray Programs for fruit pest control

By A. D. Pickett
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WE entomologists have recently been admiring ourselves while celebrating the centenary of North American professional entomology. No doubt, we have much to be pleased about, but after a critical look at pest control practices one might well ask just how much permanent progress we have actually achieved. If we subtract from our successes the portion of credit which rightly belongs to our friends, the chemists, how much credit is left for entomology? I am not going to try to answer this question other than say that I agree with Kennedy (1) when he accuses entomologists of accepting a non-biological approach in this clearly biological field.

The first flush of our outstanding successes with insecticides led us to believe that mastery over insects might be achieved by synthesizing such widely toxic poisons that in one blow we might succeed in eliminating all unwanted insect pests. Now we are being slowly but surely disillusioned; we failed to reckon with the powers of adaptability which are inherent in all organisms. At the moment, we have a wonderful array of lethal weapons at our disposal, but as Kennedy (1) has truly said: "The chemical pest controller of today is wonderfully armed, but he still bears a remarkable resemblance to young David with his flock in the Bible, fending off wild beasts by hurling things at them."

What most people fail to realize is that only a very few species of insects become pests, probably only a fraction of one per cent. Many others are potential pests because they depend on economic plants for their means of existence. The reproductive capacity of all species of living things is much higher than is required to maintain a steady population density, but the survival potential is normally low because of the environmental resistance. In general, the environmental resistance is a complex of such factors as weather, food supplies and natural enemies. If any one of these pressures is relaxed, the populations of the species concerned will undoubtedly increase.

Agricultural practices are frequently conducive to increases in pest populations. The concentrations of crops in certain areas, the continuity and the succulence of the food supply and the destruction of natural enemies are only a few of the factors which account for population increases.

When the population of a plant-feeding species rises to a point where it is doing economic damage, the grower must consider control measures in order to protect his investment. During the present century, a great deal of progress has been made in means to this end and it is now possible to control chemically practically all species of pests with which we have to deal. Technically this is a laudable achievement, but it has two major weaknesses in practice. First, some species of pests have become resistant to or developed a tolerance for some pesticides. Secondly, some pesticides are widely destructive to the fauna in general and destroy the parasites, predators and other useful species such as the pollinators, as readily as, and often much more drastically than the pest species. The situation becomes particularly serious if the biological control agents are destroyed and resistance to insecticides develops at the same time.

It has occurred to some investigators that pest control practices would be greatly improved and possibly simplified if biological and chemical controls could be harmonized and their influences combined. The skeptic will say this is a pretty but impracticable theory. After spending 12 years investigating this problem, I am quite convinced that a great deal has already been done in resolving it and that much more can and should be done on this matter.

Apple growing has been a well established agricultural industry in Nova Scotia for almost a century. The general pattern of development resembles closely that of the northeastern United States, and the problems of the growers in respect to pest

control and the means of treatment have been very similar. In fact, the Nova Scotia grower obtained his cues and purchased his spray chemicals from his American neighbor and inherited similar problems.

With the loss of the chief outlet, the United Kingdom market, for his product since the beginning of World War II, the Nova Scotian grower could no longer indulge in expensive control programs that left him a debtor after he had disposed of his crop. Therefore, he was prepared to take some risks in losing part of his production if there was a chance eventually of producing apples of good quality at a cost he could afford.

The search for chemicals that to a greater or lesser extent make the harmonizing of chemical and biological control possible has now narrowed the Nova Scotian growers' list of spray chemicals to glyodin, captan, bordeaux and mercury eradicants as fungicides; and nicotine, lead arsenate and ryania as insecticides. The virtual elimination of sulphur, dormant oils, dinitrocresol, the chlorinated hydrocarbons and the organophosphates from the program has brought about a remarkable reduction in some of the more important apple pests.

Plant-feeding mites and scale insects are conspicuous by their absence; the eye-spotted bud moth, a serious pest for many years, is at its lowest level in three decades. The codling moth has declined yearly for the past seven years and the green apple aphid has been of little economic importance for the past five years. The few growers who still use DDT have to add substantial quantities of miticides and some growers are still trying, mostly without success, to control codling moth with lead arsenate. So far, there has been no indication of the codling moth establishing resistance to DDT in this area, but the difficulties involved in controlling mites and the eye-spotted bud moth following its use, and the very considerable degree of selectivity of ryania in the control of this pest have occasioned a strong swing to the latter insecticide in this province. Ryania is also destructive to leaf hoppers, but has the distinct advantage of being harmless to most parasites and predators.

By adopting modified spray programs, many Nova Scotia growers are now averaging but two insecticidal sprays per year. No miticides are used, but a full program of sprays for apple scab control is and must be followed. Materials used must be innocuous to the beneficial fauna. Such programs have brought about a substantial reduction in production costs, have increased production of good fruit, improved the growth of the trees and reduced the hazards to orchard personnel and consumers.

A few species of pests that were common before spraying became general, such as fruitworms, cankerworms and tent caterpillars, have increased somewhat since the general adoption of the modified program, but one pre-bloom spray of lead arsenate every two or three years will handle these easily controlled pests.

Possibly it may be thought there is little in the foregoing to gladden the hearts of those who are concerned with the manufacture and sale of pesticides. This is not necessarily so. To intensify the problems of the grower is not going to improve anyone's lot. Even the most selfish person must see that it is to everyone's advantage to keep the customers in business. The agricultural chemical industry has done much to increase production and to lessen the load on the producer and the consumer of farm products; but more must be done. The primary producer must be provided with tailor-made chemicals that will reduce the pests but which will leave in the environment the parasites and predators which will continue to destroy those individuals not susceptible to the pesticide. In this way the danger of establishing resistant strains of pests will be minimized.

Merely by random searching investigators have found such selective insecticides as nicotine, pyrethrum, derris and ryania. These are more or less naturally occurring substances. Research has shown that many natural products can be improved and that chemicals can be synthesized for special purposes. Science and industry must now accept this challenge to their knowledge and know how.★★

(1) Kennedy, J. S. 1953. Insect population balance and chemical control of pests. *Chemistry and Industry*, 1953. pp. 1329-1332.

Huber Book on Clays

A new revised edition of *Kaolin Clays and Their Industrial Uses* has just been published by J. M. Huber Corp., New York, N.Y. This 214-page technical reference work discusses the minerology, composition and production of clay and contains extensive, detailed chapters on the use of clay in pesticides, ceramics, paper, etc.

A special section covers the use of clay in pesticides and deals with various aspects of pesticide formulation involving clay—and the effects of clay on the final product.

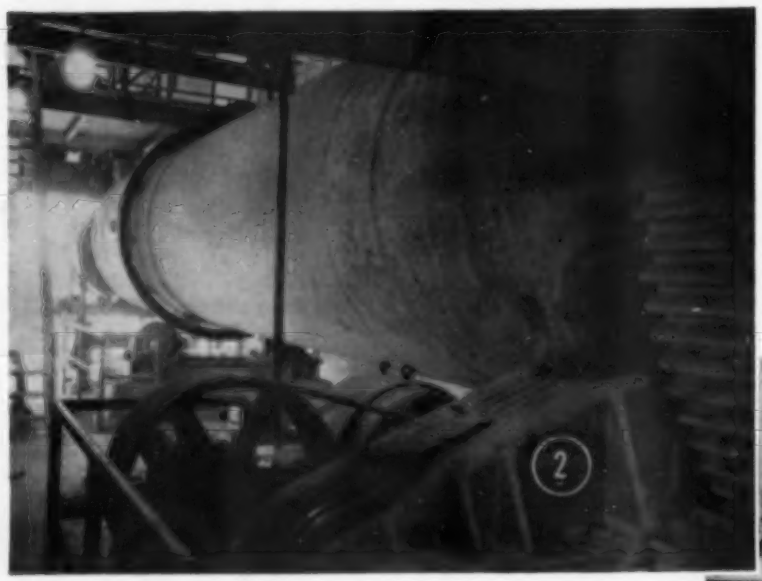
Many fruit growers are finding spray schedules involving 15 applications or so a problem. In Canada, growers have tried modified pesticide spray programs.

INDIANA GOES Granular

PERHAPS the most extensive granular mixed goods manufacturing program ever to be undertaken in the fertilizer industry has recently been completed by The Indiana Farm Bureau Cooperative Association at its Indianapolis plant.

This vast conversion-to-granulation program was planned and engineered by The A. J. Sackett and Sons Company of Baltimore, Maryland. The Sackett Company also fabricated the required process equipment and furnished field management for the building alterations, equipment installation and initial operation.

In order to accomplish maximum homogeneity in the finished product, careful consideration was given to the preparation and classification of the solid blend prior to ammoniation and granulation. This required special screening equipment to be installed in the superphosphate milling and screening tower as well as in the manufacturing phase of the plant's operation preceding the compounding and blending.



DESCRIPTION OF PHOTOGRAPHS

1. Exterior view of plant showing new granulating tower at right.
2. Rotary dryer showing drive.
3. Unloading of dryer prior to placement.
4. Two stage water cooled air compressor.
5. View showing two continuous weighing machines.
6. Four-clustered dryer cyclones.
7. View showing five of the ten liquid metering units.
8. View showing intake end of two ammoniators with variable speed drives.
9. View showing discharge of both ammoniators including blast and exhaust ducts.

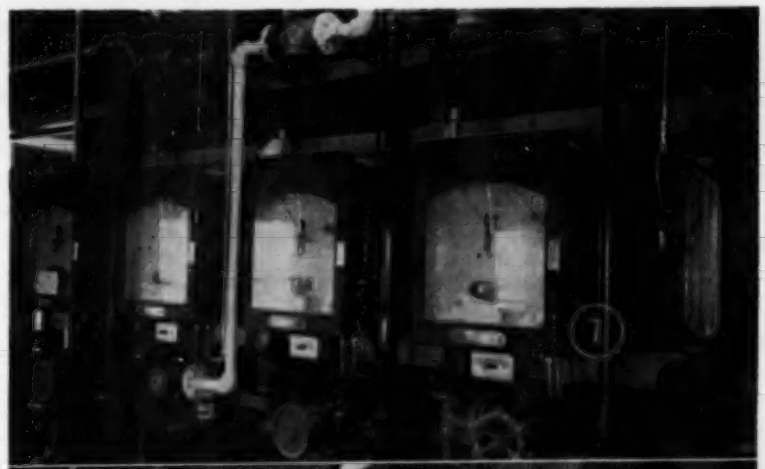
A completely new tower was erected to house the granulating process. The blended solid ingredients to be ammoniated and granulated are brought to and returned from the tower by belt conveyors. Upon entering the new tower, the blend is then elevated and fed to two continuous weighing machines, which exit their discharge to two T.V.A. type continuous ammoniators.

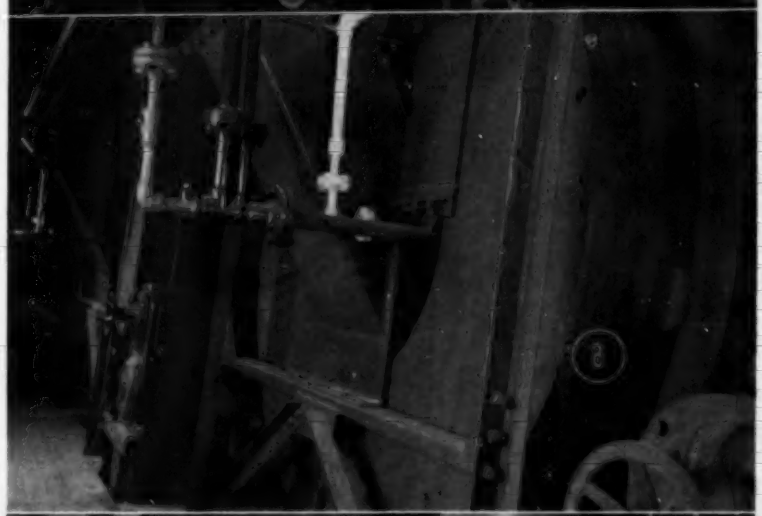
Automatic metering equipment of the indicating and recording type is supplied to accurately control the flow of nitrogen solutions, anhydrous ammonia, sulphuric acid, phosphoric acid and water, which liquids are introduced into the ammoniators under a deep cascading bed of the solid materials. The grades thus ammoniated are then conveyed to two granulators from which machines the feed is then taken to an oil fired con-current type direct heat dryer which is supplied complete with refractory-lined combustion chamber, potentiometers and quadruple cyclonic dust control equipment.

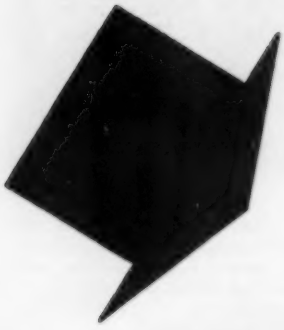
After being dried, the product is then cooled and classified by double deck electric vibrating screening equipment, from which point the finished product is taken to storage thru the plant's existing shuttle belt conveyor system. The fines from the product classifying screen and cyclones are returned for re-granulation.

It has been found that the new granular product need be kept in storage for a matter of only 24 hours prior to packaging or bulk shipping.

The mixed goods plant in which the new granulating process has been incorporated was constructed in 1939. The superphosphate plant attached thereto was erected in 1948. Both of these facilities were designed and built by The Sackett Company.







economical control of soil insects

THROUGHOUT the world very appreciable damage to practically all cultivated crops is caused by insects living partly or all of their life in the soil. Very often this damage is unrecognized. This is especially true, since they feed underground and the visible damage is not noticed or associated with these pests. Furthermore, a decrease in crop yields is not logically associated with feeding injury by soil insects, as much of this damage is not recognized. Usually, when the damage is extensive enough to produce effects upon the portion of the plants above ground, it is too late to apply remedial measures. This feeding injury results in an economic loss that reduces the cash returns for the farmer's efforts.

Recommended control measures have been established for wireworms, corn rootworms, white grubs, Japanese beetle larvae, white-fringed beetle larvae, eye gnats, seed corn maggot, sugar beet root maggot and many others. Control of these pests is accomplished by means of several toxicants which have been developed within the past few years such as DDT, chlordane, heptachlor, aldrin, dieldrin, BHC, and lindane. BHC and lindane are not recommended for control if root or food crops follow the treatment due to possible objectionable odor or taste in these crops. Prior to this time, very few insecticides were available that gave control of soil insects, and they were too expensive for general use.

Before the discovery of the above insecticides, most of the control of soil insects was by cultural practices which have not been effective or profitable. The cultural practices commonly followed were rotation of crops, avoidance of planting on newly broken sod land for most crops, fallowing the land, fall plowing to crush many of the insects or expose them to natural enemies, shallow tillage in the spring or summer to expose the insects, and planting of extra seeds per acre to allow for damage and yet obtain a good stand of the crop. Since the discovery and use of the above insecticides, these soil insect pests can be economically controlled by application of these materials to the soil just before or at the time of planting of the seeds or transplanted plants.

The Japanese beetle was first found in the United States in 1916 and soon became a recognized pest. The adults feed on a wide variety of plants, often causing complete defoliation. The larvae also cause considerable damage to lawns by destroying the root system, which results in the grass turning brown and even dying. As a result of this very noticeable injury to lawns, tests were started by Leach (2) using arsenate of lead in 1922. Based upon the information of these early tests, a recommendation was made for applying 1500 pounds of arsenate of lead to the soil per acre to permit the shipping of nursery stock from the infested area. Soon eradiction programs were started for the Japanese beetle by adding 1000 pounds of arsenate of lead per acre on lawns, city parks, etc. Eventually, this was reduced to 500 pounds of arsenate of lead per acre, which was still far too costly for general agricultural use. Less than 15 years ago DDT was introduced and after field test evaluations, it was recommended as a soil insecticide to be used at the rate of 25 pounds or more per acre. Soon after the introduction of DDT, chlordane was tested extensively and recommended for the control of Japanese beetle by applying 10 pounds to the soil per acre. Later heptachlor and dieldrin were tested and are now recommended at the rate of 2 to 3 pounds per acre to be applied to the soil. As indicated, the dosage required of the more recently developed insecticides has been decidedly reduced. Widespread usage of these insecticides in the control of this pest is now possible due to the low material cost per acre.

Wireworms are among the most injurious insect pests of both field and garden crops. Each year they cause serious damage to potatoes, corn, wheat, oats, barley, sugar beets, sugarcane, sweet potatoes, tobacco, garden vegetables and various other crops. Before the widespread use of chlordane in the control of these pests, cultural practices were used for their control, such as rotation of crops, fallowing the land, deep plowing in

late summer or early fall, shallow tillage in the spring and early summer, flooding, planting extra seeds to obtain a crop, and the use of baits such as cull potatoes to attract the larvae. During the past few years excellent control of these pests has been obtained by soil applications of chlordane, heptachlor and aldrin. These insecticides have assured the grower of a good financial return for the very low cost treatment, since only 2 or 3 pounds per acre of the newer insecticides are required.

Various methods of application of insecticides have been used to control the wireworms attacking many crops, such as:

1. Broadcast application to the surface of the soil and work into the top few inches of the soil.
2. Insecticide - fertilizer combinations applied as broadcast, banding or side dressing.
3. Furrow treatment by applying the insecticide to the furrow before covering the seed at the time of planting.
4. Combining dry insecticides with seed in planter box or grain drill.
5. In transplant water at the time of planting young plants into the field such as tobacco, cabbage, etc.
6. Seed treatment using 1 ounce or less of insecticide to treat seed for planting one acre.

During the past 5 years, corn rootworms have been recognized as a serious pest on corn and peanuts as well as other possible crops. This pest has been feeding on corn and no doubt doing considerable damage for many years, but until the newer insecticides were developed there were no control measures other than crop rotation. Soil insecticides that have been tested and proven for the control of corn rootworms are chlordane, heptachlor, aldrin, BHC and lindane. The insecticides may be applied in various ways such as: broadcast and worked into the top few inches of the soil, insecticide-fertilizer combinations, and spraying the furrow at the time of planting. Dosages as low as ½ pound per acre of these insecticides applied as a band have given excellent control of these pests. Heptachlor applied at the above dosage has increased the corn yields as much as 45 bushels per acre. Based upon the low material costs per acre and the easy methods of application, the control of corn rootworms provides cheap crop insurance.

In a paper presented by Dr. John H. Lilly (3), Iowa State College at the National Agricultural Chemical Association Meeting, St. Louis, Missouri, March 8, 1955, he pointed out the rapid and general acceptance of soil insecticides for the control of the corn rootworm in Iowa. He stated that only 25 acres were treated in 1951 which were the Iowa State College corn rootworm experimental plots. Based upon the results from these fields, 25,000 acres were treated in 1952, 125,000 acres in 1953 and 600,000 acres in 1954. This increase in acres treated in Iowa, as well as other corn producing States, indicates the results obtained by the use of these insecticides are sure and profitable to the grower.

Tests in Illinois have indicated that several insect pests attacking corn are controlled by soil applications of heptachlor and aldrin. Some of these insect pests are seed corn beetles, seed corn maggots, wireworms, corn rootworms, white grubs, grape colaspis and ants.

Root maggots are the larvae of flies that attack cabbage, onions, turnips, radishes, sugar beets and many other crops. The larvae or maggots feed on the part of the plant below ground which results in almost complete destruction of the crop. Very low dosage applications of chlordane, heptachlor, aldrin and dieldrin give almost complete protection from these pests. Various methods of application have been used such as broadcast, treating the furrow at planting time, dipping the roots of plants at time of transplanting, and drenching around the plants during transplanting.

The strawberry root weevils are very destructive pests of strawberries and many other plants in the Pacific Northwest. They feed upon the roots, often killing the plants. Insecticides, such as chlordane, heptachlor, aldrin or dieldrin applied broadcast and worked into the top few inches of

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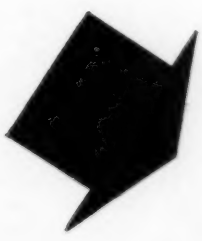

By J. Everett Bussart

Velsicol Corporation

Chicago, Illinois

Photo at right shows the increase in yield where soil has been treated with insecticide for control of rootworm. Note size of corn stalk and root development in treated, compared with untreated plots.

CAKING IN Granulated Fertilizer

Research Data From Scotland
Compiled by Vincent Sauchelli

THE advent of granulation in the fertilizer industry aroused the expectation that it would solve the problem of setting and caking of fertilizer mixtures. The reasoning behind this was well-based. Theoretically it should; but it turned out that in practice it held good up to a point. While it is true that most granulated fertilizers on the market today do not set or cake, some formulations continue to do so. Why? A contribution to the problem was published in the May 1954 *Journal of the Science of Food and Agriculture* authored by W. A. Mitchell of the Macaulay Institute for Soil Research. A brief resume of this article follows.

Samples of granular mixtures of different manufacturers and the raw materials were examined by the author. In all cases, the raw materials comprised muriate of potash, ammonium sulfate and untreated phosphate rock and normal superphosphate. X-ray crystallographic and optical methods of examination were applied to the granules, and it was found that the components had interacted during the manufacture. In all cases where ammonium sulfate and potassium chloride (muriate of potash) were used together, a double decomposition took place which can be repeated as follows:

$$x\,KCL + y\,(NH_4)_2SO_4 \longrightarrow x\,\underline{NH_4Cl} + [K_x + (NH_4)_{2y-x}](SO_4)_y$$

muriate + sulphate ammonia yields ammonium chloride + potassium-ammonium sulfate

Since there are always more ammonium ions than chloride ions, all the chloride in the final products appeared as crystals of ammonium chloride. The extra ammonium ions went to form the double salt potassium-ammonium sulfate, $(NH_4K)_2SO_4$. It is known that ammonium and potassium ions are about the same size, so that the double salt can crystallize with any ratio of ammonium to potassium.

In the mixture, some of the sulfate of ammonia also reacted with the superphosphate as follows:

$$Ca\,(H_2PO_4)_2 + (NH_4)_2\,SO_4 \longrightarrow 2\,NH_4\,(H_2PO_4) + Ca\,SO_4$$

super + sulfate → monoammonium phosphate + calcium sulfate

The optical examination revealed that the surface of the granules which caked in storage was covered with a heavy concentration of needle-like ammonium chloride crystals. This high concentration of needle-like crystals of ammonium chloride resulted from the absorption of moisture and its evaporation during changes in the humidity, creating an interlocking or binding of adjacent granules.

The author placed an individual dry granule from the caked material under the microscope and blew a small current of moist air over it; the needle crystals were seen to grow into longer needles, but they did not increase in thickness.

The author explains that when the granules come in contact with moist air, the ions of ammonium and chloride move along a film of moisture which exists between the granules and the tips of the needles and then take up their position on the crystal. This outward growth of ammonium chloride crystals in the presence of moisture is the cause of the caking. He suggests two methods of reducing the caking:

1. Reduce the concentration of ammonium chloride in the surface of the granules. The concentration seems to develop during the manufacturing process. He does not believe the double salt $(KNH_4)_2(SO_4)$ is concentrated on the surface, and although its solubility is higher than that of ammonium chloride the concentration of ammonium chloride is not caused by recrystallization from solution. The only alternative source is by sublimation; this affects the ammonium chloride more than any other salt that may be present. This is also borne out by the observation that the greatest surface concentration of ammonium

(*Continued on Page* 123)

The FOA Sponsored

UNIVERSITY of ARKANSAS-PANAMA AID PROGRAM

By R. P. Bartholomew

ASSISTING Panama in improving the agricultural economy of the Republic is the broad aim of the Agricultural Mission to Panama of the University of Arkansas. The Mission was organized in May, 1951 as a result of a direct request to the United States by the Republic of Panama for assistance under the Point IV Program to help in the development of their agriculture.

Panama has resources which are associated with a productive and profitable agriculture; fertile soils and a wide range in suitable temperatures, from tropical at sea level to temperate at the higher altitudes. However, because its economy was tied to that of the Panama Canal, almost from the time of its organization as a republic, a boom and bust type of economy developed. When activities concerning the Canal increased, there was prosperity, and on the contrary, conditions became bad whenever there was a decline in activities. This was not conducive to the development of their agricultural potentials.

The College of Agriculture of the University of Arkansas through its Mission was assigned the responsibility of providing the technical assistance and guidance for the organization and development of a teaching, research, and extension program similar to that of the Land Grant Colleges but patterned to fit the needs of Panama. This was authorized by an agreement, signed between the Foreign Operations Administration of the State Department and the University of Arkansas and the Republic of Panama, which outlined the respective responsibilities. It was the opinion of agricultural leaders and government officials of the Republic that such a program would be of greatest assistance in developing their country.

A reorganization of the activities within the Ministry of Agriculture led to the formation of a Department of Technical Agriculture which provided teaching and research in agriculture, centered at the National Institute of Agriculture and an Agricultural Extension Service, which was formally created by law in 1952. A Veterinary Department was included in the Extension Service, so that a fully staffed extension center included an agricultural agent, a home demonstration agent and a veterinarian.

In addition to the program of teaching research and extension, production projects are conducted by S. I. C. A. P., (Servicio, Interamericana Cooperative Agricultura de Panama.) The projects of this organization are financed jointly by the two governments, and the technical assistance is provided by Foreign Operations Administration of the United States Government. This program and that of the Mission complement and supplement each other. Some of the work of the United States Army Veterinarian Mission to Panama also complements and supplements the work of the Arkansas Agricultural Mission.

The grant in aid program of the Ministry of Agriculture and of S. I. C. A. P has permitted 22 Panamanians to enroll for specialized training in Colleges of Agriculture in other countries, mostly in the United States. Eight are attending the College of Agriculture of the University of Arkansas. They are making outstanding records in their special fields of study and they work on farms in the summer to acquire experience in their respective fields.

It was realized at the start that the best use in Panama of the technical advances which have been made in agriculture, such as the application of herbicides, insecticides, fungicides and fertilizers and the use of machines would come from the adaptation of recommendations made by specialists in those fields on the basis of experiments in other countries. The research program was devoted to adapting these recommendations to the conditions in Panama and the testing of varieties of corn, rice, sugar cane and beans which had been introduced as prospective replacements for native varieties and of cotton, sorghum, sesame, peanuts and soybeans which offered hopes of new crops for the country.

Fertilization and the use of other soil improvement practices will be required to maintain or increase yields, as exploitation of the soil continues. This will also be required as the program to produce feed crops for the production of more livestock and livestock products progresses.

Deficiency symptoms of phosphorus, nitrogen, calcium, boron, zinc and magnesium have been observed in plants growing in some soils. All the characteristics usually associated with phosphorus starvation have been found in cattle in certain localities. Results of "quick tests" made on a limited number of soils have shown low quantities of

phosphorus, or potassium or calcium or various combinations in different soils.

Applications of fertilizers have resulted in larger yields. Top dressing of rice with nitrate of potash one year and ammonium sulphate the second year produced larger yields of rice in experiments at the National Institute of Agriculture. Available phosphate, monocalcium phosphate at the rate of 100 pounds P_2O_5 per acre gave large increases in greenhouse trials with Sudan grass and sorghum grown in two dark colored soils from the western part of the country. Applications of nitrate of soda or potassium chloride alone or in combination did not produce any larger yields than unfertilized soil. However, when both were applied with available phosphate, the largest yields were obtained.

A 10-30-10 commercial fertilizer imported from the United States produced 36 bushels of corn per acre, almost 3 times the average of Panama when applied at a rate of 400 pounds per acre in a demonstration for higher yields. Superphosphate and ammonium sulfate applied together for rice in a field demonstration with a farmer resulted in higher yields than the unfertilized or superphosphate alone. Increased yields of coffee were reported by a few growers from the use of complete fertilizers, but they could not give specific information which could be distributed to other growers.

The use of 2, 4-D was a natural for the control of weeds in rice. It is used effectively by large operators. Hand operated low gallonage pumps, 3 gallons per acre, are used to demonstrate to the small farmer that they, too, can control weeds by spraying, instead of hand weeding with a machete. Drift damage is of little concern at present, because few crops sensitive to 2, 4-D are being grown, and fields are widely scattered.

Dinitro compounds applied as a premerge treatment of rice in preliminary experiments offer a possible solution for the control of grass when the final details for use can be worked out. An increase in yield of almost 30 per cent resulted from the premerge treatment. Ammate, 2,4,5-T, CMV, and TCA are being used in experiments to control brush in pastures, one of the big problems in maintaining good pastures in Panama.

The Extension Service educates many of the farmers in the use and application of insecticides and fungicides. A mimeographed report has been issued which lists various chemicals such as DDT, methoxychlor, toxaphene, chlordane, aldrin dieldrin, benzene hexachloride, lindane, malathion, arsenate of lead, cryolite, nicotine sulfate, rotenone, etc., and tells some of their properties and gives the groups of insects for which they may be used. This step was necessary before any efforts at control could be made effective.

Emphasis for the present is placed on DDT for the control of certain beetles, which are a serious problem for young plants. Toxaphene is used for quite a range of caterpillars. A species of fall armyworm has been a serious threat in rice production, even though outbreaks have been controlled. Aldrin, dieldrin and chlordane are recommended for control of leaf cutting ants, an ever-present problem. Malathion is used for the control of flies.

Toxaphene either as a spray or in dipping vats is recommended for the control of torsalo. This is one of the most injurious livestock insects of the tropics. Cattle ticks are also controlled by this treatment. Those familiar with the tick eradication program in the United States realize that it will take a long time and constant vigilance to clean up this problem in Panama. It is estimated that the control of these two pests will add large quantities of beef to the annual production. Other materials considered satisfactory by the veterinarians but require more constant use are Flit 222, Gamatox and chlordane.

Rice diseases common to the United States, helminthosporium blight, rotten neck, cerscospora leaf spot, white tip, virus, etc., have been noticed also in Panama. Seed treatment with Agrosan G. N. was recommended for helminthosporium blight and suggestions were given for experiments with Ceresan M., Panogen and Aagrono, which have given good results in the United States. Research to find varieties resistant to the various diseases under Panamanian conditions is underway.

Spraying for disease control in the rainy season is difficult because of frequent rains. Very little work has been done in this field. In the dry season some vegetables are grown under irrigation. One commercial producer of tomatoes reports good control of diseases with four applications of Perenox. He also states that Manzate and Dithane have given good results.

Viable planting seed of rice and corn can now be stored from one planting season to another, if it is kept in a sealed granary and the humidity maintained at approximately 55 per cent. This was determined in experiments to solve the problem of maintaining supplies of planting seed of improved varieties without importing seed each year.

Silage can be made in the rainy season from sugarcane, grass and sorghum, a new crop for Panama, and stored for feeding in the dry season according to the results of experiments in these fields. Hay also can be made according to preliminary experiments although much more work is needed. Through these practices livestock can be carried through the dry season in good condition. Irrigation with a sprinkler system for vegetable production in the dry season is practical according to tests in this field.

Approximately $20,000,000 worth of agricultural products are imported annually by the Republic and the Canal Zone, according to results of a study of the marketing and transportation system. Many of these products could be produced in Panama. However, before advantage can be taken of this market in its own front yard, central marketing facilities to include refrigerated storage must be provided. Moreover, a transportation and marketing system must be developed which will insure the regular delivery of quality prod-

(*Continued on Page* 121)

The Georgia College of Agriculture

Experiment Station...

By C. C. Murray

THE University of Georgia College of Agriculture Experiment Stations in Athens, Ga., consist of three major, four branch and four field stations; also, two federally owned stations which are cooperative with the State Experiment Station System.

These are located so that there is a research unit on every major soil type and type of farming area in the state. There are one or more stations within ninety minutes' driving time of any farmer in the state.

The Georgia Experiment Stations' research program consists of over 300 projects and subprojects, some of which are cooperative with the Agricultural Research Service and the Agricultural Marketing Service of the USDA. The research program gives major emphasis to plant and animal breeding, nutrition, feeding, management, diseases, and insect control. The tremendously important fields of farm management, marketing, and farm mechanization are emphasized.

During recent years, the Experiment Stations have made outstanding contributions to the agriculture of Georgia. As a result of planting new varieties of small grains originated by Dr. U. R. Gore, higher yields are providing additional income to our farmers of a half million dollars annually. The development and release of reseeding Dixie Crimson Clover by the Experiment Stations in cooperation with the USDA is estimated to be worth ten million dollars annually to the farmers of Georgia. The development and release of state-adapted hybrid corns is bringing new income to the farmers of Georgia of at least four million dollars annually.

Coastal Bermuda grass which has been referred to as a miracle grass is an autstanding example of cooperative research between one of our stations and the USDA. "Fifty dairy cows have been grazing on 22 acres of Coastal Bermuda from May 15 to September 15 and the grass is ahead of the cows." "It is August and I am grazing 60 head of beef cattle on 23 acres of Coastal Bermuda planted in April of this year." These are typical comments of many farmers praising Coastal Bermuda as the Cattleman's best friend. This grass is now planted on more than 200,000 acres in Georgia and is still growing in popularity. It is also widely used throughout the South.

With high fertilization, Coastal Bermuda has produced ten tons of high quality hay per acre. Fertilized with 200 pounds of nitrogen per acre along with a basic application of a complete fertilizer, this grass has produced 700 pounds of beef per acre from April to October. Tests show that Coastal Bermuda will average producing 116 pounds of beef per acre more than Common Bermuda under the same treatment. This grass was developed at the Coastal Plain Experiment Station at Tifton, Georgia by Dr. Glenn W. Burton, senior geneticist of the USDA.

(*Continued on Page* 121)

An important service to the Georgia farmer is offered by the mobile soil testing unit of the Georgia Experiment Station.

Technical SECTION

Accumulation of Pesticidal Chemicals in Soils

ALDRIN, lindane and DDT were applied to the soil as water emulsions and were either disced or rototilled in the soil to a depth of six inches, as the first step in an investigation of fundamental problems associated with the accumulation of pesticidal chemicals in soils. Objectives of the investigation are: (1) determination of the magnitude of insecticidal accumulation in midwestern soils, (2) rate and factors influencing insecticide breakdown, and (3) effect of insecticides on soil flora and non-insect fauna.

Seven field plots have been established to study the decomposition of insecticides in soils, two in Ohio (muck and loam), two in Kansas (both loam), and three in "Wisconsin (sand, loam and muck).

Concentrations of aldrin, at 2,20, and 200 lbs. acre, lindane at 1,10 and 100 lbs./acre, and DDT at 10,100, and 1,000 lbs./acre were applied.

Results of the analysis of over 450 aldrin samples indicated an apparent rapid loss of the insecticide following application. There was marked disappearance of aldrin during one season. Analyses of lindane and DDT samples are underway.

Seventeen crops were planted in one-half portion of each experimental plot at Madison, Wis. The first season's observations showed:

(a) Reduction of crop stand and weed growth especially severe on loam and sand treated with 100 pounds of lindane per acre.

(b) Cabbage and carrots showed the greatest tolerance to lindane. Cabbage grown on soil treated with 100 pounds per acre of lindane was free of worm damage and produced high yields.

(c) Alfalfa and cabbage plants showed accelerated growth on loam soil treated with 1,000 pounds of DDT per acre.

(d) In general, the deleterious effect of insecticide-contaminated soil to plants was most evident on sand and least on muck soil.

Bacteriological investigations are in progress to determine microbiological populations, ammonification, nitrification and carbon dioxide evaluation in these treated soils. An appreciable decrease of soil microorganisms has occurred in plots treated with high concentrations of insecticides. "Influence of Insecticides on Soils," T. C. Allen, University of Wisconsin, NC-19 Report.

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Khapra Beetle Control

Preliminary results of tests conducted by University of California to determine the relative susceptibility of naked Khapra beetle larvae, confused flour beetle adults, and granary weevil adults, to ten different fumigants indicated the Khapra beetle larvae were more resistant than the other two insects tested to all fumigants, with the exception of hydrocyanic acid and ethylene dibromide. The granary weevil adults were the most resistant to hydrocyanic acid and ethylene dibromide.

Results of fumigation tests conducted at 70 degrees F. with a two-hour exposure on eggs, larvae, and pupae of the Khapra beetle, indicate that the eggs are the most susceptible stage to fumigation by hydrocyanic acid, acrylonitrile, ethylene dibromide, methyl bromide, and ethylene chlorobromide. Of the ten fumigants tested hydrocyanic acid, acrylonitrile, chloropicrin, ethylene dibromide and methyl bromide are the most toxic fumigants to egg, larval, and pupal stages of the Khapra beetle.

Preliminary results with malathion used at the rate of 4, 8, 12, and 16 parts per million on wheat of nine per cent moisture content appeared to control this insect effectively. *California Agriculture*, Vol. 9, No. 4, March, 1955.

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Heptachlor, Lindane Control

Heptachlor and lindane insecticides are proving effective for protection of newly-set tobacco plants against the tobacco wireworm, report entomologists of the U.S. Department of Agriculture. Small amounts of the insecticides are added to the water used in transplanting young tobacco from starting bed to field.

During the past two years, tests of several organic chemicals at Florence, S.C., have shown heptachlor and lindane to be as toxic to wireworms as chlordane, which was recommended in 1948. This research has been carried on cooperatively by USDA's Agricultural Research Service and the South Carolina Agricultural Experiment Station.

For control of this pest, effective dosages for each 50 gallons of transplant water used are:

(1) 8 ounces of 40- or 50-per cent chlordane wettable powder.
(2) one-fourth ounce of 25-per cent lindane wettable powder;
(3) 4 ounces of 25-per cent heptachlor wettable powder; or
(4) 2 fluid ounces of a liquid concentrate containing 5 per cent of lindane.

Any one of these four treatments may be used, but no two of them should be mixed. Growers are cautioned not to increase dosage above recommended rates.

If liquid concentrates are used, they should be selected with care, since some have caused plant injury.

Vanadium Aids Plant Growth

Vanadium apparently has the same beneficial effect upon plant growth as molybdenum with a higher tolerance level on livestock, according to Davison Chemical Co.

In one of the fundamental studies on molybdenum in New Zealand conducted by Dr. H. Bortels in the early 1930's it was shown that both molybdenum and vanadium are capable of doing the same things in a legume. Both elements help in the fixation of atmospheric nitrogen by the bacteria found in the nodules on the roots of leguminous plants. The action of vanadium is not supplementary to that of molybdenum, but is an alternative at a slightly lower level of efficiency.

Investigators both in the U.S. and abroad have shown that animals have a higher tolerance to vanadium than to molybdenum. However, if vanadium is ingested in high concentrations it will, like other metals, become toxic to the animal.

Rate of application of vanadium to a pasture is the same as used for molybdenum: one or two ounces of the sodium salt. An amount between one and five ppm is fairly typical of the quantity of vanadium found in pastures. Some European basic slags contain about 0.5 per cent vanadium and also molybdenum and this may explain why such slags seem to be beneficial as dressings on pastures.

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Strawberry Weeds Controlled

A combination of chemical applications consisting of a pre-planting treatment of CIPC or DNBP, followed by post-planting treatment of SES at 30 day intervals or as needed, and CIPC or DNBP applied for control of chickweed and other winter annual weeds when strawberries were dormant, result in excellent weed control without injury to strawberry plants. These results, from a cooperative study between the Horticultural and Field Crop Research Branches, Agricultural Research Service, U.S.D.A., and Department of Horticulture, University of Maryland, indicate that hand hoeing to control weeds is generally unnecessary.

Weed control in strawberries was considered as a three-phase problem: (1) control of early-germinating weeds by pre-planting treatments, (2) control of summer annuals by post-planting treatments, and (3) control of winter annual weeds by applying herbicides in late fall or during the winter while strawberry plants were dormant.

Pre-planting treatments were effective for controlling weeds early in the season in new plantings of strawberries on loam soil, less effective on light sandy soil. DNBP at eight pounds per acre was the most satisfactory pre-planting treatment. CIPC at six pounds per acre as a pre-planting treatment injured strawberry plants in one experiment but not in two others. Control was excellent for 30 days.

Seven post-planting treatments with SES at three pounds per acre at monthly intervals did not damage strawberry plants and gave very good control of weeds for four weeks after each application. Sesin appeared promising for post-planting use and may be of value for pre-planting treatments.

CIPC at three pounds per acre applied either in mid-November or mid-February to dormant strawberry plants gave excellent control of chickweed without damage to plants.

A single application of DNBP at one or two pounds per acre in mid-February gave better control of weeds at harvest time than a split application of one pound in mid-November and one-pound in mid-December.

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CONFERENCE REPORT ON COTTON INSECT RESEARCH AND CONTROL. Seventh annual report, prepared from research papers presented at seven cotton states conferences of state and federal workers concerned with cotton-insect research and control. USDA, Entomology Research Branch, Agricultural Research Service, Washington, D. C.

Reduction of Drift Hazards in Spraying Fertilizers

FOUR basic areas of influence where reduction of drift hazard in applying 2,4-D by aircraft may be effected are: particle size of the discharged spray; horizontal air motion; vertical air motion and diffusion rate; and quantity of active 2,4-D applied in a given area.

Equipment giving the smallest number of aerosol-range drops and still remaining compatible with usual spray practices is recommended. Simple orifice or tube outlet, preferably with a smooth tapered entrance, gives the largest average drop size with the fewest number of very fine aerosol range particles. Nozzles with orifices down to 1/8 inch diameter can be used. The cylindrical jet should be directed with the air stream not more than 10 degrees below the horizontal axis of the wing section to reduce the chances of liquid spray hitting the tail assembly and fuselage. Maximum pressure should be reduced to 45 psi giving an ideal emission velocity of about 56 mph. No nozzles should be placed within three feet of the wing tips. Positive liquid control systems are essential for the 2,4-D aircraft sprayer and the suck-back system with check valves is still the best available.

Regarding horizontal air motion, the direction of the overhead wind should be known. If it is in the direction of a susceptible crop within a distance of 5-7 miles, spray application should be stopped even though temporarily the ground-air motion is quiet . . . variable . . . or even away from susceptible crop. Use of burning tires or smoke bombs is desirable for checking ground air motion.

A "colder towards the ground" condition is the most desirable for applying agricultural chemicals.

When temperature measured within 10 feet of the ground at the treatment area exceeds 80 degrees F., spraying should not be continued more than six hours after sunrise nor commenced earlier than one-half hour after sunset. At temperature less than 80 degrees, spraying can be conducted as long as other limitations do not apply. *Down To Earth*, Volume No. 10, No. 4, Spring, 1955.

BOOK REVIEWS

Applied Entomology, by H. T. Fernald and Harold H. Shepard. Fifth edition. Published by McGraw-Hill Book Co., Inc., New York. 6 x 9 inches, cloth binding, 385 pages. $7.00.

An introduction to entomology for students of agriculture. The chapters on control have been revised and expanded to include DDT and other chemicals discovered since publication of the previous edition. Space devoted to non-economic species has been reduced so that new species which have now become major pests might be included. New information about biology and distribution of particular insects has been inserted and insect physiology has been given more emphasis.

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Chemistry of the Soil, edited by Firman E. Baer. ACS Monograph No. 126, published by Reinhold Publishing Corp., New York. 6 x 9 inches, cloth binding, 373 pages. $9.00.

The chapters of this work were written by fourteen expert soil chemists. Taken together, they present a comprehensive picture of soils in relation to their development, present constitution and the uses to which they are put. Full coverage is given to chemical composition of soils, the nature of soil colloids, organic matter, relationships, oxidation-reduction phenomena, the problems involved in acid, alkaline and saline soils and plant nutrition. In addition, a special chapter is included on trace elements chemistry and the intimate relationship between plant roots and the soils in which they grow. Much of the material in this volume will be found useful by manufacturers who are in search of new ideas for product research and development.

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Soil Fertility, by C. E. Miller. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Ltd., London. 6 x 9 inches, cloth binding, 436 pages. $7.00.

Although this book focuses primarily on the plant itself, relevant aspects of soil chemistry, soil physics, soil micro-biology and plant physiology are discussed from the viewpoint of their influence on plant growth. The authors have tried to present more information on such factors as light, moisture, air, temperature, soil organisms and the colloid soil fraction and their direct relations to plant growth than is available in other books in the field.

Each major plant food element and the more important micronutrients are treated with respect to supply in the soil, sources and amounts of additions, losses from the soil, functions in plant growth and plant symptoms of deficiency.

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Chemistry of the Pesticides, by Donald E. H. Frear. Third edition. Published by Van Nostrand Co., Inc., New York. 6 x 9 inches, cloth binding, 469 pages. $8.25.

The title and text of this well-known reference book have been broadened to include rodenticides. A second major change is the rearrangement of the chapters into a sequence reflecting the present day importance of the various chemicals. For example, the inorganic compounds, which over the last years have receded in importance, are discussed after the organic compounds, thus reversing the order followed in the earlier editions.

The author has eliminated chapters giving detailed analytical procedures, and has substituted in their place a brief listing of appropriate analytical methods for each pesticide as it is individually discussed.

The orginal purpose of the earlier editions is retained—to cover the origin, chemistry, properties, methods of preparation, applications and reactions of the major classes of pesticide chemicals.

•

Two Ears of Corn, Two Blades of Grass, by D. H. Killeffer. Published by D. Van Nostrand Co., Inc., New York. 6 x 9 inches, cloth binding, 139 pages. $4.25.

The prodigious contribution that chemistry has made to human welfare and its potentialities as a tool to help man in his struggle to master the future are the themes of Mr. Killefer's very optimistic book.

Bollweevil, Bollworm Control

Fourteen insecticides were tested over a period of five years to evaluate their effectiveness as sprays or dusts to control boll weevils and bollworms in cotton. There was no difference in effectiveness of applying insecticides as spray emulsions or as dusts so long as they contained insecticides effective against boll weevils and bollworms.

Calcium arsenate dust at an average of 7 1/5 pounds per acre gave excellent control of the boll weevil but failed against bollworms. When used with DDT, however, a specially prepared lime-free calcium arsenate gave excellent control of both pests. A 2½ percent DDT-calcium arsenate mixture used at 9½ pounds per acre gave as effective control as did 5 percent DDT at this rate.

A 20 percent toxaphene dust used at 10 to 15 pounds per acre gave excellent control of boll weevils and was also effective against a medium heavy infestation of bollworms. However, in one year when boll worms were unusually destructive, the above amount of dust per acre was not effective. For such a very heavy bollworm infestation, it was necessary to apply as much as 3¾ to 4 pounds of toxaphene per acre which meant increasing the amount of dust used.

The 3-5-40 mixture used at from 10 to 15 pounds per acre was very effective against both pests. However, in a very heavy bollworm infestation such as occurred in 1951, it was necessary to increase the amount of DDT applied per acre to the amount indicated in the preceding paragraph. Under such conditions the 3-10-40 mixture was more satisfactory because the amount per acre could be held at 10 to 15 pounds and yet the amount of DDT was sufficient to bring bollworms under control.

A 2½ percent aldrin-5 percent DDT dust mixture was very effective against both pests when applied so as to use from ¼ to ½ pound aldrin and ½ to 1 pound DDT per acre.

A dust mixture of 1½ percent dieldrin-5 percent DDT was very effective against weevils and bollworms when used at ¼ to ½ pound dieldrin and ½ to 1 pound DDT per acre.

A toxaphene-DDT spray used at from 1 to 2 pounds toxaphene and ½ to 1 pound DDT per acre was very effective against boll weevils and bollworms. Used alone toxaphene as a spray was somewhat less effective than the 2-1 mixture of toxaphene-DDT. Against a very heavy boilworm infestation, from 3¾ to 4 pounds toxaphene was required per acre to obtain control.

An aldrin-DDT spray used at the rate of ½ pound aldrin and twice that amount of DDT per acre was very effective.

A dieldrin-DDT spray used at approximately ⅓ pound of dieldrin and 1 pound of DDT per acre was also very effective.

Demeton was ineffective against the boll weevil and bollworm. However, it controlled the cotton aphid and the two-spotted spider mite when used as a foliar spray or when applied to the soil. Three pounds of the technical material per acre in the soil gave a month's protection against aphids. Buln. B-441, Nov. 1954, *Agricultural Experiment Station*, Stillwater, Okla.

•

Effect of Fl on Lemon Cuttings

Concentrations of fluorine at 1, 25, 50, 100, 200 and 400 ppm were added as sodium fluoride, to silicon sand culture containing a single lemon cutting. At the highest fluorine concentration, a concentration of 485 ppm of sodium accompanied the added fluorine, and the sodium was considered a factor in retarding growth and injury in the cutting. An additional culture in which the nutrient solution contained 485 ppm of sodium as the nitrate, instead of the fluoride, indicated that the concentration of fluorine rather than that of sodium was the injurious agent.

A concentration of 400 ppm of fluorine in the culture solution was accompanied by severe leaf injury and defoliation, when fluorine was added to the nutrient solution as the fluoride of sodium or as potassium. Under ordinary inspection, fluorine tip-burn could easily be confused with the symptoms of chlorine tip-burn.

Numerous silica sand cultures with large sweet orange seedlings have shown that when the nutrient solution contained 400 ppm of fluorine supplied as sodium or potassium fluoride, a loss of chlorophyll soon becomes evident near the leaf tip and the new leaves are of reduced size. *California Agriculture*, Vol. 9, No. 3, March, 1955.

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Cabbage Worm Control Effects

Vegetable growers in Connecticut in 1953 reported to the Connecticut Agricultural Experiment Station that the cabbage worm was difficult to control with DDT dusts and sprays. An experiment was therefore carried out during 1954 at the Mt. Carmel Farm to see if an increase in resistance to DDT could be demonstrated and if any of the newer insecticides would be likely to prove satisfactory alternatives.

The materials tested were DDT, toxaphene, Dilan, dieldrin, isodrin, and endrin. Each dust was applied at a rate of approximately 32 lb. per acre, an amount normally considered necessary for satisfactory operation of a commercial duster, and one commonly used in practice.

The resistance of cabbage worms to DDT has increased about 10-fold since that material was first used in 1944. However, it still gave adequate control. Dilan was more effective, but it increased damage from aphids. Endrin was practically promising, and worthy of further study.

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Heptachlor for Alfalfa Control

Mid-April application of the insecticide heptachlor at the rate of 4 ounces per acre is recommended to Eastern farmers and cattlemen for the control of the alfalfa weevil. Entomologists of the U. S. Department of Agriculture's Agricultural Research Service report that their trials have proved heptachlor to be effective and safe for such use.

In 1954 trials, use of heptachlor sprays on April 21 knocked out large infestations of alfalfa weevils and kept their numbers at low ebb through the cutting of the first hay crop in early June. Adjacent untreated alfalfa fields were a total loss.

Literature Available

FERTILIZERS FOR SUGAR BEETS ON SOME CALIFORNIA SOILS. A detailed report of experiments with various fertilizers and soils in sugar-beet production. Bulletin B 694, California Agricultural Experiment Station and Extension Service, University of California, Berkeley, Calif.

FERTILIZERS, SOIL ANALYSIS, AND PLANT NUTRITION. Gives the facts that a farmer needs to consider in deciding which fertilizers to apply to his soil. Station Circular C 367, California Agricultural Experiment Station and Extension Service, University of California, Berkeley, Calif.

CRYSTALLINE AMMONIUM NITRATE FERTILIZER. A general description of the product together with application recommendations and handling, shipping, storage suggestions. Technical Data Sheet No. 3, Commercial Solvents Corp., New York.

DEBUGGING MADE EASY. Directions for the mixing and application of "Carco-X" pesticide and soil-treatment chemical. Pamphlet by the manufacturers, Getzum Products, Sumner, Wash.

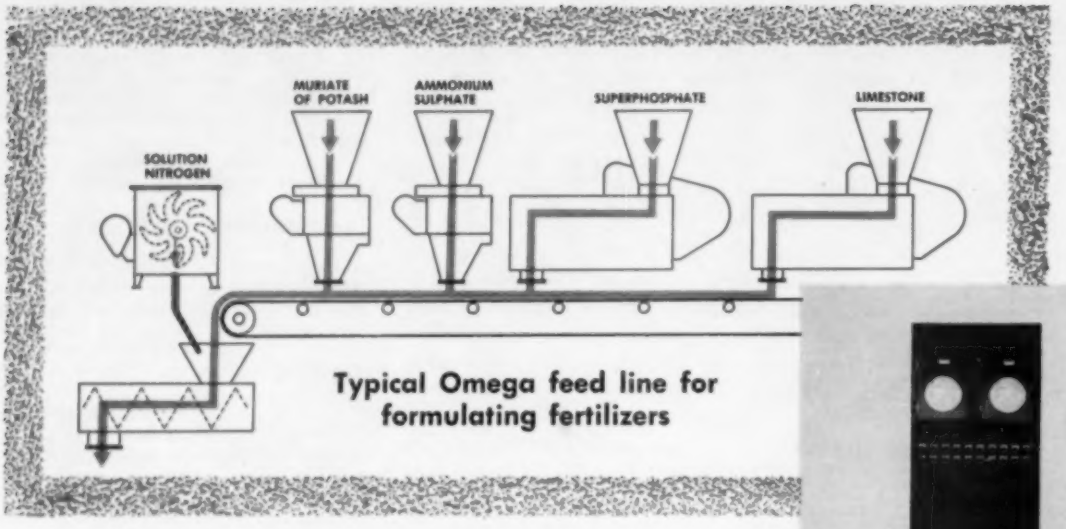
CONFERENCE REPORT ON COTTON INSECT RESEARCH AND CONTROL. Eighth annual report, prepared from research papers presented at the conference of state and federal workers concerned with cotton-insect research and control, held at Dallas, Texas, Nov. 30 - Dec. 1, 1954. USDA, Entomology Research Branch, Agricultural Research Service.

1955 WEED CONTROL IN FIELD CROPS by Stanford N. Fertig and Marvin M. Schreiber. 1955 recommendations based on conditions in New York state. Also short discussions of new chemicals, mixing of spray materials and operation of sprayer. Bulletin 821, New York State College of Agriculture, Cornell University, Ithaca, New York.

1955 SPRAY RECOMMENDATIONS FOR TREE FRUITS IN EASTERN WASHINGTON. Includes residue tolerances, safety precautions, poison antidotes, and descriptions of common diseases with illustrations. Bulletin 419 (Revised), Institute of Agricultural Sciences, State College of Washington, Pullman, Wash.

CONTROL OF FRUIT INSECTS AND DISEASES IN ORCHARDS AND HOME PLANTINGS, by L. A. Stearns, J. W. Heuberger and R. F. Stevens. 1955 spraying schedules for apple, grape and peach orchards. Extension Folder 40, Agricultural Extension Service, University of Delaware, Newark, Del.

INSECT AND DISEASE CONTROL ON VEGETABLES, by J. W. Heuberger, Donald MacCreary and R. F. Stevens. 1955 recommendations for tomatoes, lima and snap beans, asparagus, white potatoes, cucurbits and cole crops. Extension Folder 41, Agricultural Extension Service, University of Delaware, Newark, Del.



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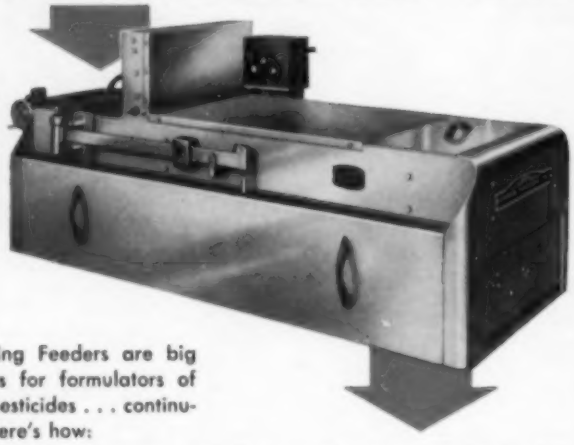

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Photos at left are those of featured speakers at the 3-day meeting.

National Plant Food Institute

Holds Preliminary Meet June 12 - 15

SOME 800 fertilizer manufacturers, suppliers, agricultural leaders, etc. are expected to gather at the preliminary convention of the National Plant Food Institute at the Greenbrier, White Sulphur Springs, West Virginia, June 12-15, 1955.

Presidents Russell Coleman of the National Fertilizer Association and Paul T. Truitt of the American Plant Food Council report that the consolidation of the two fertilizer associations will go into effect July 1st.

A highlight of the joint meeting will be a forum featuring problems relating to fertilizer-pesticide mixtures. M. V. Bailey, American Cyanamid Co., New York, will be moderator. Other participants include: C. T. Harding, Virginia Carolina Chemical Corp., Richmond, Va.; R. C. Berry, Virginia Dept. of Agriculture, Richmond; John D. Conner, Sellers and Conner, Washington, D. C. and K. D. Jacob, USDA, Beltsville, Md. Another feature will be an address by Assistant Secretary of Agriculture, E. L. Peterson.

Committees handling various activities at the 3-day session follow:

Convention Committee: Ralph B. Douglass, E. A. Geoghegan, J. A. Howell, John A. Miller, Edwin Pate, C. T. Prindeville, Paul J. Prosser, Sr., John E. Sanford, J. E. Totman, Louis Ware.

Hospitality Committee: Mr. W. F. Price, chairman; Mr. and Mrs. Horace Albright, Mr. and Mrs. Cecil Arledge, Mr. and Mrs. C. B. Clay, Mr. and Mrs. W. B. Copeland, Mr. and Mrs. J. E. Culpepper, Mr. and Mrs. Leroy Donald, Mr. and Mrs. E. M. Kolb, Mr. and Mrs. Maurice Lockwood, Mr. and Mrs. Walter Meeken, Mr. and Mrs. W. N. Watmough, Jr., Mr. and Mrs. Fred Woods.

Memorial Committee: George W. Gage, chairman; Moultrie J. Clement, F. S. Washburn, Mr. George F. Wilkins.

Tennis Committee: Dean R. Gidney, chairman; William Dunklin, vice chairman.

Ladies' Committee: Mrs. John V. Collis, chairman; Mrs. Cecil Arledge, vice chairman.

Men's Golf Committee: Mr. Gene Van Deren, chairman; Mr. R. S. Rydell, vice chairman.

Ladies' Golf Committee (including putting): Mrs. Fred Corkill, chairman; Mrs. J. D. Stewart, vice chairman.

PRELIMINARY PROGRAM

Sunday, June 12

12:00 noon-9:00 p.m.
Registration, Foyer

Monday, June 13

8:30 a.m.-6:00 p.m.
Registration, Foyer

9:30 a.m.
Meeting of the National Plant Food Institute Board of Directors-elect (meeting as a committee), West Virginia Room
Combined meeting, APFC's Agronomy Advisory and NFA's Plant Food Research Committees
Business Meeting
Forum: Problems Relating to Fertilizer-Pesticide Mixtures, Fillmore and Van Buren Rooms
M. V. Bailey, American Cyanamid Company; Moderator
K. D. Jacob, Head, Fertilizer and Lime Section, U. S. Department of Agriculture
C. T. Harding, Virginia-Carolina Chemical Corporation
John D. Conner, Attorney, Sellers and Conner
Rodney C. Berry, Virginia State Chemist

6:30 p.m.
Hospitality Hour, Courtesy of Nitrogen Producers, Auditorium Patio

8:00 p.m.
Dinner, Main Dining Room

10:00 p.m. to 1:00 a.m.
Open House, Auditorium

Tuesday, June 14

9:00 a.m.-12:00 noon Registration

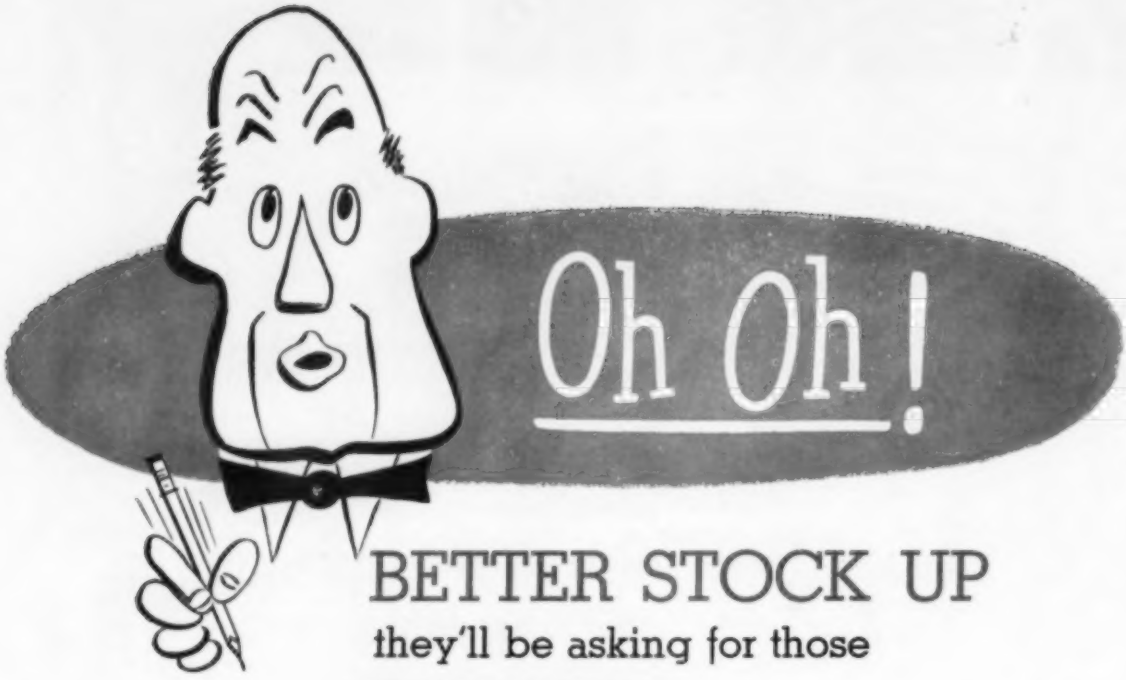
10:00 a.m.
General Session—Auditorium
E. A. Geoghegan, Presiding
Invocation, **Rev. S. D. Rexrode**, Emmanuel Methodist Church
Remarks, **E. A. Geoghegan**
Remarks, **Edwin Pate**, American Plant Food Council
Youth Panel
William B. Ward, President, American Association of Agricultural College Editors; Cornell University; Moderator
William D. Gunter, Jr., National President, Future Farmers of America, Live Oak, Florida
Joe Strickland and **Tommy Dodson**, representing the National Junior Vegetable Growers Association, Summersville, West Virginia
Lamar Ratliff, representing the 4-H Clubs, Baldwyn, Mississippi.
Address—**Hon. E. L. Peterson**, Assistant Secretary of Agriculture, U. S. Department of Agriculture

6:00 p.m.
Hospitality Hour, Courtesy of Potash Producers, Auditorium Patio

7:30 p.m. to 1:00 a.m.
Annual Banquet, Auditorium: Entertainment and Dancing

Wednesday, June 15

10:00 a.m.
General Session—Auditorium: **Mr. Pate**, Presiding
Memorial Record, **George W. Gage**
Presentation — APFC Soil Builders' Awards. **Louis H. Wilson**
Address, **Hon. Harold D. Cooley** of North Carolina, Chairman of the House Committee on Agriculture
Address, **Hon. John L. McClellan** of Arkansas, Chairman of the Senate Committee on Government Operations
Unfinished Business



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1954 FUNGICIDE TESTS

CONCLUSION

Annual summary of reports on fungicide tests by 75 collaborating pathologists who cooperate by mailing reports of their work and their findings to a committee of the American Phytopathological Society. This special Committee on Testing and Results of Newer Fungicides, of which Dr. L. G. Utter, Diamond Alkali Co., Painesville, Ohio is chairman, will, as in previous years, reprint the entire report after publication is completed (which will be in June). Reprints may be ordered at $1.00 per copy, through Dr. D. A. Roberts, Dept. Plant Pathology, College of Agriculture, Ithaca, N. Y. Test results were assembled and summarized by Dr. D. A. Roberts of the New York State Agr. Experiment Station, at Cornell University, Ithaca, N. Y.

Materials Tested for Control of Diseases of Ornamentals

CHEMICALS used against ornamental plant diseases, but which have been listed already include: Agrimycin, Captan 50-W, Crag 341, Dithane Z-78, Karathane, LO-738, Manzate, Mathieson 275 and 466, Orthocide 406, Parzate, Phygon XL, Tersan, and zineb. Other materials tested on ornamental plants were listed last month.

Gladiolus

DIPPING gladiolus corms in a Tersan (1:75)-Heptachlor (1:417) mixture is recommended for bacterial scab control in Washington (46). Control was not satisfactory when Tersan was used alone or with Agri-mycin up to 1000 ppm.

Emmi 10% Emulsifiable Concentrate or DuPont Liquid Seed disinfectant or New Improved Ceresan are recommended in corm dip treatments for Fusarium rot control in Illinois (Table 34). An experimental "dinitro compound" gave satisfactory control.

China Aster

EIGHT fungicides were tested in protectant spray applications for control of Botrytis petal spot and rust of China Aster in New York (29a). Tank mix zineb (nabam plus zinc sulfate) gave best control of both diseases in the 1954 test (Table 37).

Chrysanthemum

PARATHION (15% WP), at the rate of 1.5 lb./100 gal. in sprays at 10-day intervals, gave excellent control of the chrysanthemum foliar nematode in New York (29b). Neither End-O-Pest Rose Dust nor malathion (WP, dust, emulsifiable) gave adequate control.

Rose

BLACK spot of rose was most effectively controlled in New York (25) and in Texas (44) by protective spray or dust materials containing one of the following:

TABLE 34

Performance of materials used in gladiolus corm dip treatments for the control of Fusarium rot (12).

Material	Conc.	Order of Disease Control and Yield
Emmi 10% Emul. Conc.[a]	1:400	1
Liquid Seed Disinfectant[a]	1:400	2
1-methyl-3-fluoro-4,6-dinitrobenzene	1:1000	3
New Improved Ceresan[a]	1 oz./3 gal.	4
1,3-dichloro-4,6-dinitrobenzene	1:2000	5
1-fluoro-3-iodo-4,6- dinitrobenzene	1:2000	6
Emmi 90% WP	3.5 gm./3 gal.	7
40% Peracetic Acid	0.5%	8
3-fluoro-4,6-dinitrophenol	1:2000	9

[a]Recommended for grower use.

TABLE 36

Rating of fungicides tested for the control of black spot of rose in Texas (44).

Material[a]	Conc.	Order of Plant Safety[b]	Experimenter's Preference[c]
Captan 50-W[d]	2 lb./100 gal.	1	1
Manzate	1.5 lb./100 gal.	2	2
Crag 341	1.5 qt./100 gal.	5	4
Phygon XL	1:800 plus "Vel"	6	5
Math. 466 spray	1 lb./100 gal.	3	3
Math 466 dust	25 lb./A.	4	6

[a]Applied as protectants throughout the season.
[b]No material tested was phytotoxic.
[c]Satisfactory control obtained with each material in 1954 when the disease was not severe.
[d]Recommended for grower use.

TABLE 35

Degree of control of Alternaria blight of carnation and of snapdragon rust in New York (27).

Material[a]	Conc./ 100 gal.	% Disease Control[b] Carnation blight	Snap Rust
zineb	1 lb.		
DDT	1 lb.		
Malathion emuls.	1 qt.		
Karathane	0.5 lb.	80	79
maneb	1 lb.	95	66
zineb (Trombone sprayer)	1 lb.	80	65
zineb	1 lb.		
DDT	1 lb.		
Malathion WP	4 lb.		
Karathane	0.5 lb.	75	62
LO-738	2 lb.	85	61
zineb (Trombone sprayer)	1 lb.	75	55
Crag 7443	1 lb.	80	51
captan	1 lb.		
DDT	1 lb.		
Malathion emuls.	1 qt.		
Karathane	0.5 lb.	65	32
End-O-Pest Rose Dust	—		
Malathion 4.5%			
DDT 5.0%			
captan 7.5%			
Karathane 1.5%		80	18
captan	1 lb.	65	17
captan	1.5 lb.	60	13
none	—	0	0

[a]Plots sprayed or dusted weekly throughout the season. A trombone sprayer was used until Aug. 1; power sprayer used after Aug. 5 except where indicated.
[b]Artificial inoculations.

WHIPTAIL — Moly-deficiency disease common in such crops as broccoli, brussels sprouts, turnips. Shown here in cauliflower. Young leaves are long and narrow, irregularly shaped. Leaf tissue does not develop normally from midrib. Midrib left bare in places.

INTERVEINAL MOTTLING—As example, moly-deficient tobacco shown here. Leaves in young plants turn pale yellow between veins and sometimes around margin. Veins remain green giving leaf mottled appearance. Pale areas develop into clearly defined yellow spots.

PALE CUPPED LEAVES — Overall pale coloration appears in many moly-deficient plants, like tomato on left. Leaves often curl or cup upward around edges.

STUNTED GROWTH — In sugar beet plants compared here, deficient plant on left made almost no growth of roots or tops. Small moly deficiencies retard crop yield.

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maneb, captan, ferbam, glyodin, dichlone, copper dihydrazinium sulfate. Slightly phytotoxic to roses (25) were: DuPont All-purpose Spray (ferbam, lindane, Aramite, Methoxychlor, and sulfur), Dithane Z-78-Sulfur Rose Spray (zineb, sulfur, DDT, and Lindane), Dithane Z-78-Karathane Rose Spray, and Dithane Z-78 Rose Spray (zineb, DDT, and Lindane). Results of the 1954 test in Tyler, Texas are presented in Table 36.

Carnation and Snapdragon

MANEB and zineb were more effective than other materials tested in New York (27) for control of Alternaria blight of carnation and snapdragon rust (Table 35).

TABLE 32

Percentage control of Botrytis petal spot and rust of Asters in New York (29a).

Fungicide[a]	conc./100 gal. 1st Spray	2nd + 3rd Sprays	Others	% Disease Control Petal Spot[b]	Rust
Dithane Z-78	0.75 lb.	0.5 lb.	⅜ lb.	19	100
Liquid Parzate	3 pt., 9 oz.[c]	2 pt., 6 oz.[c]	1.5 pt., 4.5 oz.[c]	76	100
Orthocide 406	0.75 lb.	0.5 lb.	⅜ lb.	63	75
Bloomocide	2 pt.	1.5 pt.	1 pt.	25	99
Natriphene	0.5 lb.	0.5 lb.	0.5 lb.	0	53
LO-738	0.75 lb.	0.5 lb.	⅜ lb.	13	90
Mathieson 275	1 lb.	1 lb.	1 lb.	0[d]	73
XSF No. 3	2 pt.	2 pt.	2 pt.	9	95
None	—	—	—	0	0

[a]Applied at weekly intervals, beginning July 8.
[b]Artificial inoculations.
[c]Zinc sulfate.
[d]6% more disease than in control plots.

Materials Tested for Control of Diseases of Vegetables

MATERIALS which have been listed earlier, and which were used in tests for control of vegetable crops diseases are: Agrox, Arasan, Bordeaux Mixture, B856C, Captan 50W, Carbide and Carbon 224, Dithane D-14, Z-78, and M-22, DuPont I and D Seed Disinfectant, Fermate, Good-rite SSD, Karathane, LO 737, LO 738, Manzate, Mathieson 466, MEMA, Merculine, Natriphene, N521, Orthocide 406, Panogen, Parzate, Phygon, Phygon XL, Puratized C-13-1212, Setrete, Spergon, sulfur, Tersan 75, thiram, Vancide 51, and Zerlate. Other materials tested for vegetable disease control are listed below.

Seedlings

SEVEN seed treatment chemicals were tested for control of damping-off of 18 vegetable species (52). Results of these tests are summarized in Table 38.

Material	Chemical Name of Active Ingredient
Arasan SFX (D)	see thiram
B622 (Aa)	2,4-dichloro-6 (*o*-chloroanilino)-S-triazine
Carbide + Carbon L640 (B)	copper zinc chromate
Crag Fungicide 658 (B)	——
Cunilate (X)	copper derivative of 8-quinolinol
Cunimene (X)	——
Cuprosal (X)	——
Fermuline (X)	——
Formaldehyde (X)	formalin
He-177 (X)	copper ethylene bis(dithiocarbamate)
——	mercuric chloride
——	mercurous chloride
Ortho Seed Guard (A)	N - (trichloromethylthio)-4-cyclohexane-1,2-dicarboximide; γ-1,2,3,4,5,6-hexachlorocyclohexane
Orthocide 75 (A)	see captan
Ovotran (X)	——
Panogen 42 (M)	——
Panogen 5202K (M)	——
Panogen 5025S (M)	——
PCNB (H)	pentachloronitrobenzene
Phygon SP (V)	see dichlone
Puratized C-12-2525 (E)	——
Puratized C-13-1212 (E)	——
Semesan (D)	2-chloro-4-(hydroxymercuri)phenol
Semesan Bel (D)	2-chloro-4-(hydroxymercuri)phenol and isomers; 4-(hydroxymercuri)-2-nitro phenol and isomers
Tennam (X)	an organic manganese compound
Tribasic copper sulfate	basic copper sulfate
Vancide cumate (K)	——
Vancide 512 (K)	——
Vancide F407 (K)	——
Vancide F845 (K)	——
Vancide F995 (K)	——
Vancide F1056 (K)	——
No. 7443 (X)	——
No. 8076 (X)	——

Thirty-eight seed treatment chemicals were tested on Round Pod Kidney wax beans and on Alderman peas in Michigan (19). Stand data and fungicide ratings appear in Table 39. Thiram (75%), captan (75%), and Semesan have proved to be effective as seed treatments for controlling damping-off of most vegetable seedlings in New York (30). Further, dichlone has been effective on beets, carrots, spinach, and sweet corn, while chloranil is recommended for use on seed of peas and radish.

Pelleting onion seed with Tersan 75 or Orthocide 75 and Heptachlor or Dieldrin resulted in large increases in yield in Minnesota fields where soil was heavily infested with the onion smut fungus and the onion maggot (Table 40). In New York, onion smut was effectively controlled by pelleting seed with Tersan 75 or Orthocide 75 (1 lb./lb. seed), by 1:100 formaldehyde drench in the rows (100 gal./A.), or by applications of dusts containing 15% Tersan 75 or Orthocide 75 (20 lb./A. in the rows (26). Aldrin was used in each test for onion maggot control.

Cucurbits

POWDERY mildew of cucumber was most effectively kept under control in Ohio by protective sprays containing maneb, organic copper compounds, and Karathane (32). A mixture containing Dithane Z-78 (2 lb./100), Karathane (0.25 lb.), Perthane (0.5 lb.), and malathion (1.5 lb.) gave fair control of powdery mildew and aphids, but did not control angular leafspot. High yields usually were taken from plots sprayed with the mixture. Crag 658 gave good control of bacterial wilt, but powdery mildew became unusually severe on plants in Crag 658 plots. In dusting experiments in California (6), satisfactory powdery mildew control was obtained with any of the following: Ovotran, Karathane, sulfur, Arasan, LO737, and No. 466. Either of the first 2 materials is recommended for grower use. Sulfur dusts containing more than 50% sulfur were phytotoxic.

Cucumber and muskmelon plots at Beltsville, Md. were sprayed at approximately weekly intervals for 6 weeks during the growing season for downy mildew control (18a). Tribasic copper sulfate

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Ethylene Dichloride—For use as an ingredient of tetraethyl lead fluid, a fruit degreening compound and agricultural fumigant; a solvent for fats, oils and waxes; a metal degreaser; a spotting agent for textile cleaning; a chemical intermediate for use in resin manufacture and in other processes.

Diethylene Glycol—For use as a dehydrating agent for natural gas; a moistening agent for tobacco, glue and gelatin; a textile lubricant and coupling agent; a solvent in textile dyeing and printing; a constituent of hydraulic fluids; a heat transfer medium.

Monoethanolamine—For use as a gas scrubbing agent for recovery of hydrogen sulfide and carbon dioxide; a chemical intermediate in the manufacture of various surface active agents, rubber chemicals and other materials; a vehicle in the manufacture of antibiotics.

Diethanolamine—For use as an intermediate in the manufacture of surface active agents used in textile specialties, herbicides, petroleum demulsifiers, etc.; as a gas scrubber in refinery operations; as a rubber chemicals intermediate.

Triethanolamine—For use as an intermediate in the manufacture of surface active agents used in textile specialties, waxes and polishes, herbicides, petroleum demulsifiers, cosmetic preparations, cement additives, cutting oils, etc.; as a rubber chemicals intermediate.

Nonyl Phenol—For use as an anionic and nonionic surface active agent intermediate; as a starting material for the manufacture of lubricating oil additives, stabilizers, petroleum demulsifiers, oil-soluble phenolic resins and plasticizers.

Morpholine—For use in the manufacture of surface active agents, rubless waxes and polishes, rubber curing agents, corrosion inhibitors, antioxidants, catalysts, plasticizers, dyes, agricultural chemicals, separating agents, bactericides, pharmaceutical chemicals and textile lubricants.

Ethylene Carbonate—For use as a solvent for acrylonitrile polymers, lignin, nitrocellulose, nylon, vinylidene chloride-acrylonitrile copolymer, cellulose acetate and other polymeric materials; in the preparation of agricultural chemicals, resins, fungicides, pharmaceuticals and plasticizers.

Propylene Carbonate—For use in hydraulic fluids; as a solvent for cellulose resins, bisphenol resins and other polymeric materials; and as an intermediate in the preparation of agricultural chemicals, resins, fungicides, pharmaceuticals and plasticizers.

Glycerine Carbonate—For use as an intermediate in the production of glycidol; as a solvent for cellulose acetate, nylon, nitrocellulose and polyacrylonitrile; and as an extractive solvent in certain aliphatic and aromatic hydrocarbon separations. Available in trial lot quantities.

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TABLE 38

Ratings of fungicides used as seed treatments for the control of damping-off of vegetable seedlings in field plots in Ontario (52).

Crop	Ratings of Fungicides[a]						
	Arasan	Mercu-line[b]	Phygon	Van. 51[b]	Ortho. 75	B856C	Pano-gen[b]
Bean	2-U	2-S	2-S	8-S	2.5-S	2-S	4-S
Beet	8-S	2-S	2-S	32-S	12-S[c]	4-U	4-S[c]
Carrot	4-U	2-U	8-U	16-U	6-U	4-U	4-S
Citron	2-S	2-S	4-S	12-S	2-S[c]	4-S	4-S
Cucumber	2-S	2-S	4-S	12-S	3-S[c]	4-S	4-S
Dill	4-S	2-U	8-S	18-S	6-U	4-S	4-S
Muskmelon	2-U	2-S	3-S	12-U	3-U	4-U	4-S
Onion	4-S	2-U	4-U	16-S	6-U	4-S	4-U
Parsley	6-U	2-U	6-U	24-U	6-U	4-S	4-U
Pea	2-S	2-S	2-S	8-S	2.5-S	2-S	4-S
Pumpkin	2-S	2-S	4-S[c]	12-S	2-S[c]	4-S	4-S
Radish	4-S	2-S	4-S	16-S	6-S	4-S	4-S
Spinach	4-S	2-S	3-S	16-S	6-S	4-S	4-S
Squash	2-S	2-S	4-S	12-U	2-S	4-U	4-S
Swiss Chard	8-S	2-S	4-S	32-S	12-S	4-S	4-S
Tomato	4-S	2-U	4-S	10% soln. —U	—	4-S	4-S
Veg. Marrow	2-S	2-S	4-S	12-S	2-S	4-S	4-S
Watermelon	2-S	2-S	4-S	12-S	2-S	4-U	4-S

[a]Arabic numerals denote no. oz. material/100 lb. seed. S: satisfactory and recommended for use; U: unsatisfactory.
[b]Liquid.
[c]Preferred by experimenter.

CMFWLYUP

TABLE 39

Emergence of bean and pea seedlings in field plots in Michigan, and rating of seed treatment chemicals (19).

Seed treatment Materials[a]	Emergence (%)[b]		Rank of fungicide	
	Bean	Pea	Bean	Pea
Orthocide 75 plus Dieldrin	63.9	53.9	1	20
Semesan[c]	59.9	61.3	2	6
DuPont I + D	58.6	60.6	3	8
Ethyl B-856	57.2	69.6	4	1
thiram plus Dieldrin	55.5	52.0	5	22
MEMA	54.9	61.8	6	5
Merculine	52.9	59.9	7	10
Orthocide 75	52.8	61.2	8	7
Fermuline	52.5	60.0	9	9
Setrete	51.5	59.2	10	13
Arasan SFX	50.6	62.7	11	4
Panogen (4 oz.)	49.9	59.8	12	11
Vancide F995	49.7	51.9	13	23
Phygon SP	48.9	59.0	14	14
Puratized C-13-1212[c]	47.9	59.5	15	12
thiram[c]	47.7	54.2	16	18
C + C L-640[c]	47.0	65.1	17	3
Vancide 51 (6 oz.)	46.8	49.0	18	24
Ortho Seed Guard	45.6	58.1	19	15
Agrox[c]	45.4	60.0	20	9
Vancide 512	42.8	45.5	21	28
Puratized C-12-2525[c]	40.6	54.5	22	17
C + C L-224[c]	39.4	67.6	27	2
Panogen	38.0	55.4	28	16
Cunimene	35.6	43.5	29	30
Vancide F407	35.5	46.1	30	26
Vancide F1056	33.9	43.2	31	31
Vancide Cumate	32.7	33.7	32	38
Cunilate	30.5	36.5	33	36
Spergon[c]	28.6	37.5	34	35
Ethyl B-622 WB	25.2	41.8	35	33
Panogen 5202 K	25.1	42.1	36	32
Natriphene[c]	22.7	34.1	37	37
Vancide F845	22.5	22.7	38	39
Panogen 5025S	5.4	48.1	40	25
None	20.8	39.0	39	34
LSD (P = 0.01)	11.6	10.0		
LSD (P = 0.05)	8.8	7.5		

[a]Treatments at rate of 2 oz./100 lb. seed, except where stated otherwise.
[b]Figures based upon 5 replications of 200 seeds each.

Data for tables below:

TABLE 40

Yield of onions grown from pelleted seed and cost of pelleting materials (21).

TABLE 42

Performance of materials applied as sprays in rows at planting time to control white rot of garlic (4).

TABLE 43

Yield and incidence of downy mildew of lima beans in a spray test on Long Island (23).

[a]Artificial inoculation July 20. Pods harvested Sep. 1-8.
[b]Differs significantly from best treatment, P = 0.05.
[c]Differs significantly from best treatment, P = 0.05.

Pelleting Materials	Oz./lb. seed	Yield T/A.	Cost of Materials/A.
None	—	1.89	—
Tersan 75 and 5% sticker	10.6, —	2.00	$5.06
Tersan 75, Heptachlor 50%	3,1	5.22	1.64
Tersan 75, Dieldrin 50%	3,1	5.88	2.71
Orthocide 75, Dieldrin 50%	3,1	5.90	3.44
Heptachlor 50% and Tersan 75	2	6.23	1.49
Orthocide 75	5.3	6.97	4.21
Orthocide 75	10.6	9.17	7.93
Tersan 75	5.3	9.97	3.02
Tersan 75	10.6	11.30	5.47

Material	lb./A.	Order of		
		Disease Control	Yield	Experimenters' preference
Mercuric chloride	12.5	1	1	2
PCNB[a]	25	2	2	3
Mercurous chloride[a]	12.5	3	4	4
PCNB[b]	12.5	4	3	1
N521 90W[c]	5	5[d]	5	7
Captan 50W	6.25	6[d]	6	5
Captan 50W	12.5	6[d]	7	6

[a]Mildly phytotoxic.
[b]Less costly than and/or less phytotoxic than treatments which gave better control.
[c]Phytotoxic.
[d]Control not satisfactory.

Fungicide	Amt./100 gal.	Yield (Av. no. pods/plot	Downy Mildew (% pods infected)[a]
Tribasic copper sulfate	4 lb.	802	0.1
Manzate	2 lb.	861	0.1
Copper-manganese	4 lb.	789	0.4
Dithane D-14 + $ZnSO_4$	2 qt., 0.75 lb.	858	0.6[b]
7443	2 lb.	831	1.2[c]
8076	2 lb.	928	1.3[c]
Captan 50-W	2 lb.	860	2.0[c]
Liquid Vancide + $ZnSO_4$	2 qt., 0.75 lb.	891	4.4[c]
F 995 W Vancide	2 lb.	826	5.5[c]
None	—	886	6.3[c]

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(3 lb./100 gal.) did not give satisfactory control. Best control was obtained with Tribasic (3 lb.) plus Dithane Z-78 (2 lb.) and with Tribasic (4 lb.) alternated with Dithane Z-78 (2 lb.). Tribasic alternated with Fermate (2 lb.) did not satisfactorily control the disease. Sprays containing both Tribasic and Zerlate (2 lb.) gave fair control, while alternating these 2 fungicides gave fair control on muskmelon, but was unsatisfactory for control on cucumbers.

Maneb or zineb sprays or dusts are recommended for cucumber anthracnose and downy mildew control in South Carolina (38). Results of field tests are presented in Table 41.

TABLE 41
Performance of spray and dust materials tested for cucumber disease control in South Carolina (38).

Material	Concentration	Order of Disease Control		
		Anthracnose	Downy Mildew	Fruit Rot[a]
Dusts				
Orthocide 406[b]	7.5% captan	2	7	6
Dithane Z-78[c]	3.9% zineb	7	5	8
Manzate[c]	4.2% maneb	3	1	1
Ethyl B622[d]	4.0% active	8	4	2
Vancide F995W[e]	6.0% active	6	8	7
Dithane M-22	4.2% maneb	4	6	3
Sprays				
Dithane Z-78[c]	2 lb./50 gal./A.	5	3	5
Manzate[c]	1.5 lb./50 gal./A.	1	1	4

[a]Not satisfactorily controlled.
[b]Recommended in special cases to check anthracnose.
[c]Recommended for grower use in protective schedules.
[d]Ineffective against anthracnose; further testing unwarranted.
[e]Ineffective against downy mildew; further testing unwarranted; Dust respirator must be used to safeguard operator.

Garlic

PCNB (12.5 lb./A.), when applied as a spray in the row at planting time, effectively controlled garlic white rot, caused by *Sclerotium cepivorum* (Table 42).

Lima Beans

TRIBASIC copper sulfate or Manzate or a copper (48%)-manganese (4%) mixture controlled downy mildew of lima beans on Long Island when applied as sprays at 125-150 gal./A. at weekly intervals beginning July 8 (Table 43). Parathion was used as the insecticide on all plots, and B-1956 (½ pt./100 gal.) was used as a spreader-sticker with each material tested.

Onions

IN fields where downy mildew and blast of onions occurred, 6 applications of maneb (2 lb./80 gal./A.) or captan (3 lb./80 gal.) or nabam (2 qt./80 gal.) resulted in yields which were mathematically significantly higher than those from non-sprayed plots (31).

Potatoes

IN plots where little or no late blight occurred, yields from plants sprayed with either maneb or captan were better than those from plants which had been sprayed with Bordeaux mixture or COCS, or with nabam for 5 applications and Bordeaux mixture 3 times (24).

In Ohio, protective sprays containing maneb, Tennam 10, LO-738, SDD plus zineb, or SDD plus zinc sulfate controlled early blight and plots receiving these sprays were the highest yielding ones (32). In one experiment where early blight became severe, satisfactory disease control was obtained with zineb, regardless of concentration and pressure used. Concentrations of 8X at 20 gal./A. and 60 p.s.i., 4X at 40 gal./A. and 60 or 20 p.s.i., and 2X at 80 gal./A. and 60 p.s.i. were effective. For the third successive year, data indicate no adverse effects of organic protectants upon chipping qualities of potatoes. In plots where there was no disease problem, yields from Bordeaux mixture sprayed plots were significantly less than those from non-sprayed ones.

Results of an experiment in which 8 materials were tested as seed piece dips for seed piece rot control appear in Table 44.

TABLE 44
Rating of materials tested as potato seed piece dips for rot control in Alaska (49).

Material and concentrations tested	Order of Disease Control	Experimenter's Preference
Semesan Bel 1:32, 1:64, 1:28	6	5
Parzate 1:250, 1:500, 1:1000	2	4
Manzate 1:250, 1:500, 1:1000	4	3
Dithane D-14[a] 1:25, 1:50, 1:100	8	7
Formaldehyde (cold)[a] 2%, 4%, 8%	7	8
Mercuric chloride[a] 1:500, 1:1000, 1:2000	5	6
Talc (H_2O suspension) 1:500	1	1
Fermate 1:125, 1:250, 1:500	3	2

[a]Phytotoxic. Do not warrant further trials.

Tomatoes

SOUTHERN blight was effectively controlled by PCNB (10 lb./A.) when put in the row in a pre-planting application using 1 gal. of suspension/100 ft., and the material is recommended for grower use, on a trial basis only, in South Carolina (38). Neither zineb nor captan was satisfactory from the standpoint of disease control, and these materials do not warrant further testing.

Excellent control of both anthracnose (13, 32) and early blight (13, 18, 32) was obtained with maneb in Maryland, Illinois, and Ohio. Alternate applications of ziram and fixed copper also controlled anthracnose in Maryland (18). Maneb at 8 lb./100 gal. and 37.5 gal./A was as effective against early blight as it was at 2 lb./100 gal.) and fixed copper (32 lb.), applied either with a concentrate sprayer at a rate off of 37.5 gal./, were as effective as 1X sprays applied with a dilute sprayer. Results of a test in Illinois (13) are presented in Table 45.

When used throughout the season at approximately 5-day intervals, zineb, maneb, LO738, nabam plus zinc sulfate, and nabam plus manganous sulfate all gave good control of tomato late blight in Florida (9). Results of a second test of materials for late blight control are presented in Table 46.

One of the following is recommended in Virginia (45) for use in a 4-

(*Continued on Page 125*)

TABLE 46
Ratings of materials tested for tomato late blight control in Florida (9).

Material[a]	Conc./100 gal.	Order of		
		Disease Control	Yield	Preference
Tribasic copper sulfate	4 lb.	3	2	3
SDD + $ZnSO_4$[b]	1 qt.,1 lb.	4	3	4
SDD + $ZnSO_4$ + X75[b]	1 qt.,1 lb., 1 qt.	4	3	4
He-177[b,c]	2 lb.	2	1	2
nabam + $ZnSO_4$[c]	2 qt., 0.75 lb.	1	2	2
nabam + $ZnSO_4$ + X75[c]	2 qt., 0.75 lb., 1 qt.	1	1	1
Phenylmercury dimethyl-dithiocarbamate	1 lb.	4	4	4
Phenylmercury dimethyl-dithiocarbamate	2 lb.	4	4	4
None	—	5	5	5

[a]Seventeen applications, Jan. 26-Mar. 29.
[b]Some phytotoxicity.
[c]Satisfactory control.

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LISTENING *Post*

Experimental Control of Gray Mold and Ghost Spot of Tomatoes

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Epidemics and Identification Section, Horticultural Crops Research Branch, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

GRAY mold of tomatoes, caused by the fungus *Botrytis cinerea*, has been known in Florida for many years, according to J. F. Darby of the Florida Agricultural Experiment Station. Heretofore, it has been considered only as a minor fruit rot, occurring mostly in transit, but in recent years it has become recognized as a serious disease in the field, where it attacks the foliage as well as the fruit. Spraying with nabam and zinc sulfate, zineb or maneb has not controlled it. Only a few years ago, the disease in the field appeared to be largely restricted to the Indian River area, but the diseased area has gradually extended, so that at present gray mold is a serious problem throughout most of southern Florida. Losses attributed to it have ranged up to 50 percent of the yield.

The occurrence of a disease known as ghost spot has closely paralleled that of gray mold. Both diseases first became serious in the Indian River area just after World War II, and the areas now severely affected by the diseases are approximately the same. Losses due to ghost spot are difficult to estimate because they depend in part on prevailing market conditions. When the demand for tomatoes is good, friuts showing a few ghost spots are either ignored or placed in a lower grade, while only the severely spotted fruits are rejected; however, when the demand is poor, all spotted fruits are rejected.

Field observations support the theory that ghost spot is caused by *Botrytis cinerea* under conditions that do not permit the fungus to become sufficiently established to cause rot. With few exceptions, conditions favorable for gray mold resulted in a typical rot of the fruit, whereas unfavorable conditions resulted in ghost spot. Occasionally both diseases occurred on the same fruit.

All of the materials employed in control experiments were applied as sprays. In tests conducted in the winters of 1951-52 and 1952-53, the applications were made with a small self-propelled power sprayer adjusted to deliver 250 to 300 p.p.s.i. at the pump. This sprayer was equipped with a hand-carried boom and a shut-off valve. The boom was attached to a 100-foot hose, which was pulled between the rows to reach various parts of the field. The sprayer used in the winter of 1953-54 was a high clearance (6 feet), tractor-mounted, independently-powered sprayer adjusted to deliver 300 p.p.s.i. at the pump. From 3 to 12 nozzles per row were used, depending upon the size of the plants.

Intervals between applications varied from 3 to 7 days, depending upon severity of the diseases. The average number of applications per season was around 20. The gallons per acre applied ranged from 50 to 250, in proportion to the size of the plant.

Four replicates, arranged in a pattern of random distribution, were used for each treatment. The spacing between plants within rows was 2 feet, and the inter-row distance was 7 feet. Plots were separated by single guard rows to minimize the effect of the drifting of materials. Each longitudinal half of the guard rows was sprayed with the material applied to the adjacent plots. Thus, there was an over-lapping of spray materials on the guard rows. In the winter of 1951-52, the plots consisted of 2 rows, each 28 feet long. In the following winter, 1952-53, the length of these rows was extended to 30 feet. In the winter of 1953-54, each of the 4 plots per treatment was enlarged to 8 rows 80 feet long. In the last test, the data were collected from the 2 rows in the center of the 8-row plots.

Dichlone-zineb mixtures were prepared by thoroughly mixing proportionate quantities of the wettable powders of dichlone and zineb together. These mixtures were stored in closed circular cardboard containers and used as needed. No evidence of deterioration or incompatibility in storage was noted.

The plots were inspected daily for the presence of diseases. When there appeared to be enough differences between treatments to warrant taking data, all plants were examined and scored.

The tomatoes were picked mature-green, weighed, and counted at approximately weekly intervals. Each fruit was examined at the time of harvest for the presence of lesions or rots. The fruits were sorted into marketable and unmarketable.

Insecticides were included in the tank with the fungicides once a week. The insecticides used were wettable parathion or DDT or a mixture of the two.

In the earlier trials using small, standard-sized plots, dichlone decreased the incidence of gray mold, but it was not so effective as the other

(Continued on Page 115)

Yellow Clover Aphid, Armyworm, Corn Borer Pose Threat

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

By Kelvin Dorward

Yellow Clover Aphid Continues Serious

THE yellow clover aphid, which in 1954 was first reported as being an economic pest of alfalfa, is fast becoming one of the major pests in the Southwestern States. The aphid is spreading rapidly in California, as well as several other States. During March a total of 125,000 acres of alfalfa were treated in Imperial county and continued applications are necessary. In some fields treatments were being repeated every eight days. Infestations ranged from light to heavy in both San Bernardino and Riverside counties. Heavy infestations were found in the desert areas of San Diego county but light in the coastal areas. A rapid increase of the population was reported in all southern Arizona counties and the difficulty of control, because of quick build-up, was causing concern. The aphid continued as the major crop pest in New Mexico the last of April. Infestations of epidemic proportions were recorded in the Pecos and Hatch Valleys and damaging populations were noted throughout the southern half of the state. Activity continued to be reported from Texas with considerable damage to alfalfa in El Paso county. Oklahoma reports very heavy infestations in the north-central area, with some fields in Grady county needing to be replanted. In the Stillwater area some stands were reduced as much as 75 per cent. The insect is now known to be in several Kansas counties but at the last report no controls had been required, although new destructive levels were found in some fields. Since this pest is proving rather difficult to keep under control, agricultural authorities within the respective states should be contacted for control recommendations.

Armyworm Causing Damage

ARMYWORMS which during the past two years have caused heavy destruction are again causing damage in several states. Reports early in May state that outbreak numbers of small larvae were occurring in middle Tennessee. In Madison Parish, La., counts up to 22 larvae per square foot were reported. Infestations were becoming very severe in oat fields where the soil was completely shaded. Outbreaks were continuing in western and northern Alabama counties. Infestations in Georgia were light to heavy in practically every county south and west of Macon. Some oat fields were destroyed in Sumter and Houston counties before the damage was noted. Oats were destroyed and fescue cut back sharply in a heavy infestation in Carteret county, N. C. Counts up to 200 larvae per square yard were recorded. Moths were noted in flight at Newark, Del., April 21 and by the first of May specimens had been taken at Duluth, Minn., and Scarboro, Maine. Larval infestations were reported from southern Illinois by late April and 153 moths were collected from a light trap in the eastern area of that state on April 3. In Missouri, economic infestations of small larvae were reported from the southeastern and southwestern corners of the state, with moderate moth flights throughout the state. Kansas reported moths in grain fields of the central and southeastern areas the first week of May. Moths were also abundant in central Iowa.

European Corn Borer Reports

RECENT surveys in Iowa show a state average of 14,209 live borers per acre which is around three times as heavy at this time as a year ago when 4,183 borers were found per acre. Pupation was well underway in this state in early May, and had reached 17 per cent in the central area by May 9. By this time also pupation in Illinois ranged from 0-3 per cent in northern counties to 80 per cent in the southern area. Ten per cent pupation was recorded at Lafayette, Indiana, May 3, and by May 7 pupation was getting underway in South Dakota. In this latter state, a survival of around 77 per cent has been noted in some fields. Earlier in the spring winter mortality figures for the borer were received from North Dakota and Minnesota. An average mortality of 9.6 per cent was found for Cass, Richland, Barnes and Ransom counties, North Dakota. An average of 19 per cent of the borers examined in 28 counties in Minnesota were dead, comparing with 25 per cent mortality in spring of 1954 and 20 in 1953.

Notes on Other Cereal and Forage Insects

BY the first of May grasshoppers were hatching and causing concern in several areas. Populations of 50 to 100 nymphs per square yard were found in spots on the San Carlos Indian Reservation in Graham county, Arizona. In Texas, counts up to 50 per square yard were reported from Falls, McLennan and Robertson counties. Newly hatched nymphs were found in all fields surveyed in 12 central and north-central Kansas counties. In Missouri, the hatch was principally in the southern half of the state. Hatching began during the first week of April in southern Arkansas, and by the end of the month larvae were found in alfalfa and other forage crops in the northwestern part of the state. Numbers appeared above normal for the time of year.

Various cutworms were causing damage in widely separated areas. The granulate cutworm was reported from many areas of Alabama as causing damage to cotton, corn, peanuts, vegetables and other plants. Clay-backed cutworms were especially destructive to small grain, lespedeza, clover and alfalfa in west-

(*Continued on Page 113*)

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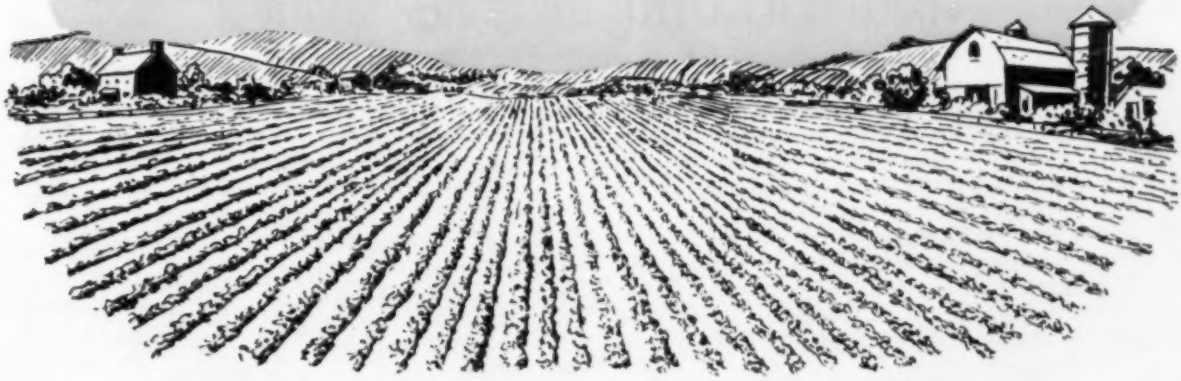

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WASHINGTON *Report*

by
Donald G. Lerch
Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

CONGRATULATIONS are in store for the leaders of the fertilizer industry for the adroit manner in which they are handling their consolidation. The current June meeting of the two Washington associations at the Greenbrier, White Sulphur Springs, W. Va., demonstrates the ability of the industry to close ranks and carry on the main tasks confronting it.

Washington is the scene of scores of mergers and consolidations which go on with monotonous regularity. Few, however, give the appearance of being more skillfully executed. Of course, many problems, some of them rather ticklish, are being discussed this month. It's likely that not everyone will be satisfied. And, of course, since the consolidation legally becomes effective in July, another meeting of the governing Boards will be necessary then to put into effect those decisions now in the making.

Aside from internal business, the convention has a strong promotional flavor evidenced by William B. Ward's chairmanship of the Youth Panel, featuring representatives of the 4-H Clubs, Future Farmers of America, and the National Junior Vegetable Growers Assn. Mr. Ward is the current president of the Agricultural College Editors Association and Director of Extension Information for Cornell University, Ithaca.

Addresses by members of Congress and Government officials present plenty of subject matter for delegates to consider.

Farm income is being discussed more and more these days in view of the big drive to maintain the sales volumes of companies supplying farmers with fertilizers and pesticides. From the point of view of total dollars, farm income is down considerably, dropping 5% below a year ago for the first quarter of 1955.

However, on the basis of income per farmer,—per capita income has been increasing rather steadily. For instance, during 1954, farm income dropped 3% under the year previous but there were 3½% fewer people sharing in the total. As a result, per capita income rose from $914 in 1953 to $918 in 1954. As the reduction in farm population continues, the prospects are that per capita income will increase still more.

* * *

President Eisenhower's program for low income farm families recognizes the plight of farmers who are not keeping pace with improved technology and the increased capital investment throughout agriculture generally. Businessmen will note that the program has been given to True Morse, Under Secretary of Agriculture, who was an executive in the Doane Agricultural Service, a leading national farm management company, prior to his appointment.

This is an attempt to strip the problem of its emotionalism and to use the resources of the community and the U. S. Government to provide the extra skills necessary for these people to go into other work, or to enlarge their own farm operations to such a level that a decent profit can be earned and a satisfactory living standard maintained.

In the opinion of the Under Secretary, the program will benefit not only agriculture and the businesses which serve it, but will also help the towns and cities through a net increase of productivity.

* * *

The House approval of higher price supports for agricultural commodities, makes it doubly certain that farm programs and price supports will be a major issue in the forthcoming presidential election. Secretary Benson is committed and will continue to fight for flexible price support rather than the rigid levels approved by the House. The issue is firmly cast, and while individual Congressmen and Senators may have views which conflict with their party's policy, the GOP and Democratic standard bearers must stand or fall on the basis of present battle lines.

* * *

The National Agricultural Chemicals Association is broadcasting special messages about growing uses for herbicides over about 500 radio stations from coast to coast. The program, under the direction of Lea S. Hitchner, executive secretary, and Jack Dreesen, herbicide specialist, is being received enthusiastically by the nation's leading radio farm directors and most stations serving substantial farm audiences.

Mr. Dreesen has personally visited many college campuses and has attended many key herbicide meetings throughout the country, recording authentic statements by the specialists themselves.

Subjects and speakers are as follows:

1. "Boost Corn Profits With Herbicides"—Dr. C. J. Willard, Ohio State University.
2. "Six Most UnWanted Weeds"—Dr. Fred W. Slife, University of Illinois.
3. "Prescription For a Weed-Free Farm"—Dr. Neal Shafer, University of Nebraska.
4. "Weed Killers Can Be Plant Killers"—Dr. Lowell Rasmussen, State College of Washington.
5. "Latest Advances in Cotton Weed Control"—Dr. W. B. Ennis, Jr.,

(*Continued on Page 113*)

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1953 - 1954 FERTILIZER CONSUMPTION in the U. S.

By Walter Scholl, Hilda M. Wallace & Esther I. Fox

Fertilizer and Agricultural Lime Section
Soil and Water Conservation Research Branch
Agricultural Research Service
U. S. Department of Agriculture
Beltsville, Maryland

FOR the year ended June 30, 1954, the consumption of fertilizers in the United States and Territories amounted to 22,773,499 tons or 2.73 percent less than the consumption in 1952-53. This quantity comprised 22,157,986 tons of products containing one or more of the primary nutrients (N, available P_2O_5, K_2O) and 615,513 tons of the secondary and trace element materials which did not contain primary nutrients. The consumption of these fertilizers was, respectively, 377,135 tons (1.67 percent) and 261,974 tons (29.86 percent) less than that in 1952-53.

Although the tonnage of fertilizers used in 1953-54 was lower than in 1952-53, a new record in total consumption of primary nutrients was set for the fifteenth consecutive year. Thus the consumption of these nutrients amounted to 5,895,558 tons, an increase of 4.42 percent (249,502 tons) over that in the preceding year. The consumption of nitrogen increased 12.85 percent (210,360 tons) to 1,847,416 tons and that of K_2O 3.90 percent (67,792 tons) to 1,806,042 tons, whereas the consumption of available P_2O_5 decreased 1.26 percent (28,650 tons) to 2,242,100 tons. The content of total P_2O_5 in all fertilizers decreased 4.28 percent (118,317 tons) to 2,646,971 tons.

The average primary nutrient content of fertilizers bearing primary nutrients was 26.61 percent in 1953-54 as compared with 25.05 percent for the preceding year.

The data presented herein were compiled from manufacturers' reports of

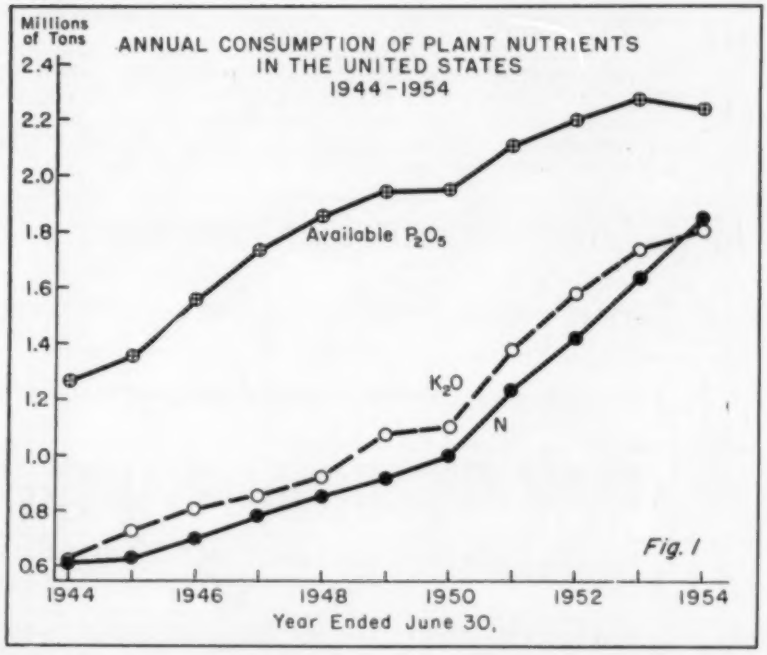


Fig. 1

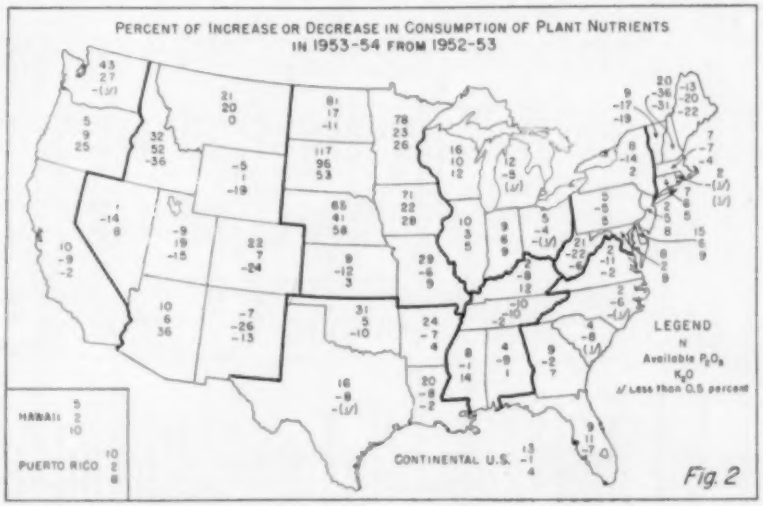


Fig. 2

Table 1. - Consumption of fertilizers, Year Ended June 30, 1964[1/]

State & Region	Mixtures			Materials[2/]			All fertilizers 1963-64	Relative Consumption 1952-53 = 100	
	July 1 - Dec. 31, 1963	Jan. 1 - June 30, 1964	Total	July 1 - Dec. 31, 1963	Jan. 1 - June 30, 1964	Total		Fertilizers [3/]	Total N, Avail. P_2O_5 & K_2O
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Percent	Percent
Maine	17,708	147,047	164,760	2,816	4,216	7,032	171,792	91	91
New Hampshire	1,464	10,381	11,845	861	2,286	3,147	14,992	74	74
Vermont	3,180	24,436	27,616	2,999	4,878	10,877	38,441	77	88
Massachusetts	10,180	86,996	89,116	4,180	11,972	16,902	86,018	100	99
Rhode Island	1,839	11,616	13,455	633	1,378	2,011	15,466	100	100
Connecticut	6,896	68,808	68,203	3,826	21,308	25,033	90,236	104	106
New England	40,651	311,282	361,913	17,706	47,078	64,848	416,786	89	88
New York	94,485	418,689	513,162	32,736	66,366	98,305	609,445	91	96
New Jersey	80,636	216,403	266,038	8,361	16,619	24,970	291,008	106	106
Pennsylvania	166,080	488,097	608,177	24,090	47,680	72,770	680,947	97	100
Delaware	13,609	76,366	89,775	931	5,177	6,108	96,891	106	109
District of Columbia	846	1,842	1,907	486	823	791	2,698	106	106
Maryland	73,806	216,421	290,028	8,900	14,718	20,618	312,645	105	106
West Virginia	12,191	84,680	67,861	2,722	6,610	9,332	77,193	88	89
Middle Atlantic	401,857	1,486,976	1,837,913	82,990	148,908	230,798	2,068,706	98	100
Virginia	147,463	627,646	686,101	22,226	91,666	113,892	799,063	94	98
North Carolina	216,046	1,273,600	1,490,646	46,220	312,163	358,365	1,849,199	98	98
South Carolina	100,946	671,078	672,023	41,708	227,389	269,096	941,121	96	96
Georgia	189,161	944,565	1,102,706	80,280	216,068	296,328	1,399,054	96	104
Florida	416,334	686,196	1,071,530	46,118	67,068	113,192	1,184,681	105	104
South Atlantic	1,069,929	3,982,077	5,022,006	206,788	914,324	1,121,088	6,163,099	98	100
Ohio	308,914	709,228	1,018,142	26,180	61,676	76,026	1,094,169	93	99
Indiana	286,604	789,496	1,084,100	49,756	106,875	156,628	1,180,728	98	106
Illinois	169,280	461,540	631,820	411,562	465,076	876,637	1,508,147	91	108
Michigan	166,691	368,540	545,231	17,612	37,349	54,181	600,392	93	99
Wisconsin	70,210	331,931	408,141	10,496	23,864	34,062	441,208	106	112
East North Central	941,699	2,679,835	3,621,134	513,707	697,737	1,201,804	4,822,838	98	104
Minnesota	48,286	205,289	251,544	20,145	51,086	71,231	322,775	121	132
Iowa	66,065	354,611	420,644	80,875	180,421	261,294	682,158	118	126
Missouri	141,663	327,062	468,725	114,778	173,107	287,886	756,620	91	108
North Dakota	6,419	16,639	23,058	2,952	14,667	24,619	47,677	118	121
South Dakota	2,299	11,100	13,399	4,676	11,952	16,608	30,007	180	208
Nebraska	12,790	83,156	95,946	41,897	91,275	133,170	189,116	136	157
Kansas	68,728	45,947	99,670	63,640	52,579	116,219	215,889	90	86
West North Central	351,252	991,844	1,345,116	356,961	645,166	861,128	2,224,242	106	123
Kentucky	65,979	320,794	452,775	55,269	93,521	129,810	581,663	98	100
Tennessee	70,153	324,899	395,132	40,502	88,460	128,962	524,094	90	92
Alabama	91,604	745,949	837,833	113,722	232,289	346,961	1,183,494	94	95
Mississippi	19,889	334,819	354,408	140,371	239,949	380,320	734,728	100	107
East South Central	286,846	1,804,261	2,039,946	329,864	554,169	884,053	3,023,999	98	100
Arkansas	18,996	174,831	193,797	36,892	141,288	176,880	370,677	101	108
Louisiana	28,581	144,781	173,362	44,824	100,480	144,804	318,166	100	104
Oklahoma	24,823	40,191	64,814	30,148	30,828	60,476	124,990	99	108
Texas	80,645	230,724	291,367	126,908	165,900	279,808	560,995	99	106
West South Central	152,553	590,527	723,060	266,972	428,996	695,768	1,394,828	100	106
Montana	1,108	3,151	4,234	11,894	12,974	24,868	29,102	112	120
Idaho	72	6,714	6,786	30,756	52,452	83,208	89,994	122	141
Wyoming	66	2,324	2,379	2,965	5,888	8,853	11,232	88	94
Colorado	3,264	11,468	14,690	10,146	22,958	33,084	47,774	97	110
New Mexico	172	1,975	2,147	5,870	14,646	20,216	22,362	81	88
Arizona	5,619	15,943	21,462	20,843	94,896	115,739	136,201	112	108
Utah	270	5,361	5,631	9,427	18,369	24,796	30,417	89	102
Nevada	201	672	873	2,737	5,845	8,582	9,156	84	93
Mountain	10,616	48,876	58,192	112,338	224,707	337,046	395,237	106	112
Washington	5,777	23,068	29,650	58,689	115,172	171,661	201,271	131	134
Oregon	4,819	17,660	21,979	45,347	80,074	125,421	147,400	99	107
California	83,268	136,080	223,264	801,680	722,042	1,504,702	1,728,966	108	106
Pacific	93,864	176,808	272,893	885,676	916,288	1,801,764	1,874,637	109	108
Continental U. S.	3,347,948	12,010,807	15,288,068	2,941,720	6,542,266	7,108,986	22,362,089	98	104
Hawaii	30,227	28,927	59,164	36,246	44,650	80,896	140,048	108	108
Puerto Rico	92,238	131,680	223,689	25,454	22,119	47,663	271,412	110	108
Alaska[4/]	---	---	---	---	---	---	---	---	---
Territories	122,476	160,547	283,023	61,679	66,756	128,437	411,460	109	107
Total: 1963-64	3,470,022	12,171,084	15,841,076	2,808,399	4,629,024	7,232,425	22,773,499	98	104
1962-63	3,667,360	12,034,866	15,722,224	3,067,921	4,622,885	7,690,806	23,412,030	100	100
1961-62	3,635,604	11,552,848	15,084,540	2,866,988	4,489,111	7,346,099	22,432,414	96	92

1/ Includes: Ground phosphate rock, basic slag, secondary and trace element materials, such as, borax, sulfur, manganese sulfate, etc., used as separate materials, also fertilizers distributed by Government agencies. Does not include liming materials, but includes gypsum.
2/ Excludes the quantities of materials used for manufacture of commercial mixtures.
3/ Fertilizers which were guaranteed to contain primary plant nutrients (N, P_2O_5, K_2O).
4/ Not available: Consumption of all fertilizers in 1962-63 amounted to 685 tons.

Table 2. - Consumption of Principal Liquid Fertilizers in the Continental United States, by Grades, Years Ended June 30, 1963 and 1964

Grade	Consumption		Proportion of Total		Grade	Consumption		Proportion of Total	
	1962-63[1/]	1963-64	1962-63	1963-64		1962-63[1/]	1963-64	1962-63	1963-64
	Tons	Tons	Percent	Percent		Tons	Tons	Percent	Percent
0-0-24	4,082	5,668	0.03	0.04	6-6-6	288,870	305,320	1.85	1.96
0-0-27	22,427	15,610	.17	.10	8-8-8	274,165	288,134	1.77	1.89
0-10-10	5,194	4,267	.04	.03	8-8-12	42,706	40,244	.28	.26
0-20-20	62,893	49,130	.41	.32	8-8-16	2,882	2,706	.02	.02
0-20-30	52,324	48,008	.33	.30	8-8-8	8,824	8,534	.06	.06
0-20-40	2,790	2,749	.02	.02	8-8-8	13,886	11,048	.09	.07
0-32-12	128,981	90,343	.83	.65	8-8-8	8,177	8,271	.06	.06
0-32-16	2,280	2,708	.02	.02	8-8-12	70,840	64,309	.46	.36
0-32-20	22,470	20,121	.19	.13	8-8-27	2,808	3,025	.02	.02
0-32-24	2,017	2,970	.01	.02	8-10-4	89,788	87,216	.59	.57
0-32-56	4,076	5,554	.04	.05	8-12-4	3,845	3,985	.02	.02
0-34-6	5,858	6,813	.04	.05	8-12-8	53,809	51,808	.35	.34
0-36-7	76,552	92,960	.49	.61	8-12-12	186,286	186,274	1.09	1.21
0-44-10	22,706	8,800	.17	.05	8-12-16	5,976	4,283	.03	.03
0-44-14	268,286	277,498	1.72	1.16	8-20-20	3,848	4,533	.02	.02
0-10-10	21,888	13,632	.11	.08	8-24-0	20,026	21,534	.20	.14
0-20-20	12,676	17,999	.09	.12	8-24-12	52,908	62,087	.18	.22
0-10-0	9,808	12,881	.06	.08	8-24-24	6,334	13,286	.04	.08
0-20-10	26,770	22,908	.18	.15	7-0-11	0	5,087	.00	.03
0-20-20	268,129	243,182	1.57	2.26	7-0-7	2,870	3,690	.02	.02
0-20-10	5,888	5,828	.02	.04	7-0-8	0	3,418	.00	.02
0-20-30	6,882	11,088	.04	.07	7-7-7	30,208	38,418	.21	.24
0-30-0	7,787	8,044	.05	.05	7-7-10	61	4,188	(2/)	.02
2-12-6	166,447	61,084	1.01	.38	7-0-4	3,168	3,183	.01	.02
2-12-12	499,208	494,096	2.83	2.64	7-0-8	3,911	3,548	.03	.02
3-0-6	6,442	4,808	.04	.03	8-0-8	13,061	16,384	.08	.11
3-0-8	16,996	12,748	.11	.08	8-0-12	20,127	6,886	.07	.04
3-0-8	671,216	620,284	4.84	3.89	8-0-24	18,861	20,088	.12	.13
3-0-8	468,898	469,238	2.98	2.81	8-4-4	2,870	2,866	.02	.02
3-0-12	38,078	28,981	.28	.19	8-4-8	11,498	27,279	.07	.24
3-0-12	7,061	9,808	.05	.06	8-6-4	6,138	8,443	.04	.04
3-0-16	184,888	113,708	1.00	.75	8-6-4	4,851	5,838	.03	.02
3-0-27	118,008	128,984	.76	.81	8-8-4	7,722	7,546	.05	.05
3-10-4	2,098	2,888	.02	.02	8-8-4	21,060	20,087	.14	.13
3-12-12	7,727	6,809	.06	.04	8-8-8	542,248	594,471	3.21	3.67
3-12-6	478,878	278,296	3.10	1.82	8-8-10	6,027	5,878	.03	.04
3-12-8	1,882	3,290	.01	.03	8-10-12	15,861	11,742	.09	.08
3-12-12	2,241,187	1,730,944	14.50	11.84	8-12-12	19,747	27,838	.10	.18
3-18-9	114,816	72,766	.74	.48	8-12-16	84,989	17,021	.83	.11
4-8-4	6,186	6,801	.04	.04	8-16-8	7,882	7,882	.05	.05
4-8-8	17,280	19,868	.13	.10	8-16-16	67,484	84,782	.44	.52
4-8-8	51,267	46,399	.33	.32	8-24-8	128,141	123,809	.09	.84
4-7-6	130,603	180,530	.86	.98	8-24-12	789	2,883	(2/)	.02
4-8-4	12,736	13,287	.09	.09	8-28-6	68,976	72,178	.36	.47
4-8-6	481,178	520,699	3.11	3.30	9-6-6	8,032	6,823	.04	.03
4-8-8	530,422	523,854	3.34	3.58	9-9-10	2,808	2,808	.01	.02
4-8-10	62,488	67,800	.41	.37	9-16-8	4,086	3,780	.03	.03
4-8-12	78,761	81,841	.51	.54	9-24-6	1,236	2,822	.01	.02
4-8-8	77,400	76,642	.50	.50	10-0-10	34,304	44,737	.22	.29
4-10-6	861,802	498,719	5.76	3.27	10-0-12	1,993	2,528	.01	.02
4-10-7	827,094	862,412	5.01	5.61	10-6-10	5,218	5,027	.02	.03
4-10-8	8,810	6,584	.04	.04	10-8-6	3,181	2,868	.02	.02
4-10-10	9,686	9,018	.06	.06	10-8-4	28,474	26,256	.18	.18
4-12-4	198,110	162,817	1.24	.93	10-10-0	10,307	8,007	.12	.08
4-12-6	7,348	2,883	.05	.02	10-10-6	27,880	20,971	.24	.20
4-12-8	180,948	182,806	1.04	1.00	10-10-10	401,079	701,288	2.60	4.60
4-12-12	206,860	270,014	1.32	2.45	10-12-20	4,418	3,860	.03	.03
4-12-16	3,132	2,661	.02	.02	10-16-8	3,027	2,888	.04	.02
4-12-24	1,736	3,110	.01	.02	10-16-8	10,468	8,848	.07	.07
4-16-0	28,982	11,996	.17	.08	10-20-0	121,300	117,049	.78	.77
4-16-8	71,286	62,486	.46	.34	10-20-10	23,286	48,714	.18	.32
4-16-16	478,321	498,177	3.08	4.88	10-20-20	2,800	9,088	.02	.06
4-24-12	61,271	68,070	.39	.46	10-30-10	6,381	3,624	.04	.02
5-5-5	2,408	3,040	.02	.02	12-0-20	12,484	14,140	.08	.09
5-8-4	1,894	2,864	.01	.02	12-0-12	10,307	8,149	.07	.05
5-8-8	7,621	8,208	.05	.05	12-6-6	4,449	3,863	.03	.02
5-8-10	1,846	2,538	.01	.02	12-8-8	2,880	3,897	.02	.02
5-8-8	1,487	2,708	.01	.02	12-12-6	3,288	3,788	.02	.02
5-8-8	7,782	7,861	.05	.05	12-12-12	78,072	808,922	.47	1.87
5-7-8	22,877	24,068	.17	.16	12-24-0	9,860	12,743	.06	.08
5-7-10	8,141	8,726	.05	.06	12-24-12	36,891	31,864	.24	.21
5-8-7	19,982	16,840	.13	.11	13-13-13	16,786	24,198	.10	.16
5-8-8	4,622	4,830	.03	.03	14-0-14	30,809	38,892	.20	.25
5-10-6	877,288	821,124	5.68	5.28	14-14-0	8,008	8,282	.05	.05
5-10-10	1,118,741	1,287,766	7.22	8.44	14-14-14	0	2,882	.00	.02
5-10-15	33,221	80,404	.22	.52	15-0-12	3,078	4,837	.02	.03
5-10-16	16,318	8,882	.11	.06	15-8-4	14,682	8,651	.09	.06
5-10-20	3,788	7,819	.02	.05	15-16-0	82,404	78,402	.51	.52
5-15-10	22,881	10,040	.16	.07	16-0-0	2,704	3,874	.02	.02
5-15-15	4,084	17,319	.03	.11	16-10-0	0	8,868	.00	.04
5-15-30	4,023	4,747	.03	.03	17-7-0	32,807	18,706	.21	.12
5-20-10	17,117	44,710	.11	.29	18-18-0	0	3,880	.00	.02
5-20-20	87,076	200,808	.57	1.27	20-0-20	1,339	4,847	.01	.03
6-3-6	22,487	26,182	.16	.17					
6-4-6	8,063	11,047	.05	.07	176 Grades	15,000,790	14,853,006	97.12	97.86
6-4-8	14,290	21,804	.09	.14	Other specified grades[3/]	218,492	280,807	2.05	1.84
6-6-6	79,218	81,067	.52	.53	Grades not known[4/]	228,803	123,840	.83	.81
6-6-9	15,868	14,189	.07	.09					
6-8-12	8,293	11,089	.05	.08					
6-8-16	9,788	12,874	.06	.08					
6-7-7	8,224	8,272	.05	.04					
6-8-2	2,276	3,829	.01	.03					
6-8-4	218,173	168,862	1.39	1.11	Total[5/]	15,448,082	15,258,068	100.00	100.00

1/ The tonnages of 48 grades were increased by amounts originally reported as "other specified grades." Their combined amount of increase was 12,194 tons. 2/ Less than 0.01 percent. 3/ There were approximately 1,149 in 1962-63 and 1,044 in 1963-64. 4/ There were, at least, 800 grades not shown by their guaranteed analysis. 5/ Does not include the quantity of mixtures consumed in the Territories.

shipments to agents, dealers, distributors, and farmers in the Territories (except Alaska), the District of Columbia, and the States except California, Florida, Massachusetts, Missouri, North Carolina, South Carolina, and Texas. For the latter seven States the data were compiled chiefly from the reports of the respective fertilizer control officials. No data were available for Alaska. Supplementary information was furnished by the control offices and other State agencies, as well as by fertilizer brokers, and special inquiries were made of all known distributors and custom applicators of anhydrous ammonia.

The quantities are reported as 2,000-pound tons. Although the data refer to shipments, the terms "consumption," "sales," and "shipments" are used synonymously. The actual consumption differs slightly, no doubt, from either the shipments or sales.

All Fertilizers

THE consumption of the two classes of fertilizers, mixtures and materials, is summarized by States and regions in Table 1. The tonnage of all fertilizers consumed in each of 16 States, the District of Columbia, Hawaii, and Puerto Rico was higher than in 1952-53.

Based on the tonnages for each six-month period of 1952-53, most of the decrease in total consumption of all fertilizers in 1953-54 occurred in the July-December period. Consumption for this period in 1953-54 was 781,930 tons (11.57 percent) below that for the corresponding period of 1952-53, while for the January-June period consumption was 142,821 tons (0.86 percent) above the quantity for the same period of 1952-53. During the fall period, there was a decrease of 317,338 tons of mixtures and 464,592 tons of materials, while in the spring period the consumption was higher by 136,190 tons of mixtures and 6,631 tons of materials.

Regional distribution of the consumption of all fertilizers in 1952-53 and 1953-54, as percentages of the country totals, is shown in Table 1a.

Table 1a. — Regional Percentage Distribution of Consumption of All Fertilizers

Region	1952-53	1953-54
New England	2.01	1.83
Middle Atlantic	9.05	9.08
South Atlantic	26.79	26.97
East North Central	21.79	21.18
West North Central	8.95	9.77
East South Central	13.62	13.28
West South Central	5.99	6.12
Mountain	1.55	1.73
Pacific	8.64	8.23
Territories	1.61	1.81
United States	100.00	100.00

In Table 1, the percentage change in consumption of fertilizers in 1953-54 as compared with 1952-53 is based on the tonnage of primary nutrient fertilizers only, in order that a direct comparison may be made with the percentage change in consumption of the primary nutrients themselves.

Mixtures

MIXED fertilizers consumed in the United States and Territories amounted to 15,541,076 tons, as compared with 15,722,224 tons in 1952-53. The quantity of mixtures consumed in 1953-54 was 68.24 percent of the total fertilizer tonnage, as compared with an average of 67.46 percent for the preceding five-year period. In 1953-54, 1,319 grades were reported by their guaranteed analyses. It is estimated that additional grades approximating 500 were reported under unspecified designations.

Consumption of individual grades of mixtures in total quantities of 2,500 tons or more in the continental United States is shown in Table 2. In 1953-54, there were 176 of these grades totaling 14,853,606 tons and accounting for 97.35 percent of the total quantity of mixtures consumed. Other reported grades numbered 1,044 and totaled 280,907 tons, and approximately 500 grades reported under unspecified designations totaled 123,540 tons.

Consumption of mixed fertilizers in Hawaii and Puerto Rico totaled 283,023 tons in 141 grades (all specified). While most of the grades in Puerto Rico are similar to those used on the Continent, many in Hawaii are designated in fractional numbers.

The tonnages of the ten grades most favored in the continental United States are shown in Table 2a. The total tonnage of these grades accounted for 50 percent or more of the total tonnage of mixtures consumed in the continental United States in both 1952-53 and 1953-54. Grades 3-12-12, 5-10-10, and 5-10-5 were the only ones of this group that retained the same relative position in both years. Grade 3-9-6 ranked fourth in 1952-53 but dropped to sixth place in 1953-54, being exceeded in tonnage by grades 10-10-10 and 4-16-16.

The tonnages of the 15 principal grades consumed in each of the continental regions and Puerto Rico in 1953-54 are shown in Table 3, together with the tonnages of these grades for each State in the region.

Table 2a.—Ten Principal Grades of Mixed Fertilizers Consumed in Continental United States, Years Ended June 30, 1953 and 1954

Grade	Consumption		Proportion of Total Consumption of Mixed Fertilizers in Continental U. S.	
	1952-53	1953-54	1952-53	1953-54
	Tons	Tons	Percent	Percent
3-12-12	2,241,137	1,730,944	14.50	11.34
5-10-10	1,115,741	1,287,746	7.22	8.44
5-10-5	877,240	821,116	5.68	5.38
10-10-10	401,079	701,365	2.60	4.60
4-16-16	473,321	698,177	3.06	4.58
3-9-6	671,216	608,256	4.34	3.99
4-10-7	527,094	552,416	3.41	3.62
4-10-6	581,802	498,719	3.76	3.27
3-9-9	455,699	489,239	2.95	3.21
2-12-12	409,203	404,036	2.65	2.65
Total	7,753,532	7,792,014	50.17	51.08

The total tonnage of these 15 grades represents 55 percent or more of the consumption of mixtures in each of the regions.

Among the individual States, the total number of specified grades ranged from 16 for Nevada to 782 for Florida. For California, the number originally reported was 599, but subsequent information from the State fertilizer control office indicates over 800; some 200 grades were originally included in the unspecified group.

The consumption of mixtures by classes (N-P-K, N-P, P-K, N-K) for each region and the United States is shown in Table 5. Except for the Mountain region, N-P-K mixtures were favored over all other classes. More than 73 percent of the tonnage of all mixtures consumed in each of the other regions was of this class. N-P mixtures were consumed in largest tonnage in the Mountain region. For the United States, 90.40 percent of the tonnage of all mixtures was of the N-P-K class, while for the other classes — N-P, P-K, N-K — consumption was 2.46 precent, 5.76 percent, and 1.38 percent of the total tonnage, respectively. These proportions have not changed greatly from year to year. Over the past several years, however, the proportions of the N-P and N-K classes have steadily increased; in 1949-50, they were 1.45 and 0.60 per cent, respectively.

The national weighted average primary nutrient content of mixed fertilizers increased from 25.84 percent in 1952-53 to 26.87 percent in 1953-54 (Table 7). The average, for 1953-54, comprised nitrogen, 5.01; available P_2O_5, 11.59; and K_2O, 10.27 percent. The average percentages of these nutrients in 1952-53 were 4.63, 11.34, and 9.87, respectively. As compared with 1952-53, the increase in the average was 8.21 percent for nitrogen, 2.20 percent for available P_2O_5, and 4.05 for K_2O. The average primary nutrient content of all mixtures consumed in each State and Territory is shown in Table 7. These averages for the 51 political units covered showed, for nitrogen, increases in 34 decreases in 7; for available P_2O_5, increases in 35 and decreases in 16; for K_2O, increases in 35 and decreases in 17; and for total primary nutrients, increases in 42 and decreases in 9.

Table 4. - Principal Fertilizer Materials Consumed as Such, Year Ended June 30, 1954[1]

Tons

State & Region	Chemical Nitrogen Materials					Natural Organics		Phosphate Materials				Potash Materials		Total Primary Nutrient Materials	Secondary and Trace Element Materials[2]
									Superphosphates						
	Ammonium Nitrate	Ammonium Sulfate	Calcium Cyanamide	Sodium Nitrate	Other[3]	Dried Manures	Other[3]	Phosphate Rock[3]	Grades 22 Percent and Under	Grades Over 22 Percent	Other[3]	Chlorides 50 & 60 Percent Grades	Other[3]		
Maine	1,257	78	264	281	23	412	247	28	4,205	0	140	24	20	6,904	78
New Hampshire	930	28	49	125	18	168	420	34	2,007	0	67	64	20	3,976	11
Vermont	407	2	6	166	168	62	84	80	9,804	0	36	216	17	10,947	30
Massachusetts	1,144	67	205	1,195	141	1,662	5,765	319	3,809	0	778	488	0	16,763	139
Rhode Island	79	67	122	129	25	209	739	49	334	0	142	76	5	1,992	19
Connecticut	884	36	92	726	86	1,406	13,847	106	4,436	39	1,066	1,078	1,271	24,764	269
New England	4,890	288	738	2,622	499	4,116	21,108	618	24,595	39	2,220	1,943	1,351	64,296	646
New York	14,419	349	2,606	5,787	2,366	5,242	9,788	1,276	52,730	161	1,221	913	801	96,358	946
New Jersey	2,380	166	1,932	2,880	1,728	2,710	3,194	1,241	5,709	174	1,087	1,428	144	24,711	259
Pennsylvania	4,355	2,873	1,552	1,788	1,809	2,940	6,713	7,562	36,908	51	3,108	676	107	70,232	2,586
Delaware	2,124	24	246	167	1,788	155	209	106	728	60	100	296	86	5,988	120
District of Columbia	9	4	0	64	5	114	368	0	28	49	153	3	0	788	8
Maryland	1,472	114	1,256	3,662	1,762	731	579	1,677	6,239	12	466	265	1,999	20,233	286
West Virginia	766	392	9	1,767	564	399	672	466	4,292	46	79	57	1	9,299	33
Middle Atlantic	25,836	3,762	7,800	16,116	9,972	10,271	21,518	12,327	106,634	884	6,143	5,826	2,787	226,609	4,185
Virginia	8,237	124	1,440	30,300	27,681	689	1,022	3,427	9,877	801	1,145	1,605	14,681	97,499	16,463
North Carolina	16,091	346	6,873	141,248	116,469	360	1,697	1,986	17,896	89	10,044	10,380	10,624	333,791	84,782
South Carolina	24,841	879	1,529	99,184	85,780	406	798	1,812	80,247	3	8,396	19,066	9,944	266,384	2,744
Georgia	26,426	1,177	1,930	93,818	72,499	599	745	770	16,668	277	15,813	10,496	5,368	244,695	21,435
Florida	10,048	4,006	2,257	17,028	22,174	734	6,728	12,893	7,643	140	5,338	2,806	17,986	110,188	2,966
South Atlantic	81,642	6,534	16,029	381,848	325,803	3,067	10,990	21,297	72,350	810	40,736	44,333	80,295	1,062,724	68,366
Ohio	13,697	7,658	1,473	1,122	10,398	1,178	6,999	2,874	16,589	3,520	678	2,278	1,287	78,907	619
Indiana	48,919	8,811	2,416	270	27,725	1,045	1,476	27,012	17,141	5,686	890	19,972	412	166,141	467
Illinois	56,948	36,037	1,300	117	46,566	4,667	7,184	563,976	64,420	12,047	4,808	98,165	251	673,862	766
Michigan	13,000	6,498	311	666	4,314	2,973	8,870	3,807	11,761	361	806	1,193	563	64,310	861
Wisconsin	6,662	184	84	0	2,562	982	6,034	12,656	2,810	136	103	3,943	972	38,827	236
East North Central	118,200	59,236	5,583	2,175	91,542	10,906	30,263	617,106	111,821	21,736	10,287	120,836	3,065	1,198,647	2,887
Minnesota	13,249	1,046	36	6	10,744	525	3,408	5,120	10,796	17,673	6,969	1,346	0	70,907	324
Iowa	49,140	4,907	384	0	47,423	147	3,216	25,423	52,772	10,670	12,638	8,739	569	231,222	72
Missouri	44,004	9,849	20	246	33,826	990	2,331	168,644	8,367	4,940	8,065	18,811	1,279	287,750	136
North Dakota	425	70	0	0	85	0	51	40	90	14,819	6,925	14	0	24,899	80
South Dakota	3,108	408	8	7	1,836	0	1096	161	1,841	4,997	4,139	13	2	16,608	0
Nebraska	40,784	4,046	0	0	47,308	1,761	909	4,963	4,498	17,082	11,182	128	0	132,884	686
Kansas	26,826	5,963	0	0	11,808	291	1,321	7,908	3,866	23,883	35,047	776	0	115,209	110
West North Central	178,801	26,965	348	259	182,823	3,714	11,320	200,249	81,440	94,184	103,907	27,827	1,850	879,879	1,247
Kentucky	29,705	1,272	1,669	2,221	3,966	320	219	9,135	46,686	4,200	12,133	8,916	9,316	128,704	106
Tennessee	37,049	370	1,084	18,765	9,318	782	761	624	20,098	6,303	18,036	10,369	9,101	128,870	392
Alabama	52,602	1,280	634	99,370	46,680	467	200	3,416	39,631	427	68,930	10,964	130	344,918	1,049
Mississippi	113,997	6,630	11,845	60,283	58,356	19	0	6,783	37,938	1,473	80,583	22,551	208	380,295	28
East South Central	233,353	9,552	15,232	179,619	118,289	1,588	1,170	18,958	144,322	12,413	180,682	52,772	18,754	982,481	1,572
Arkansas	39,180	10,869	12,055	32,086	22,546	49	0	2,580	16,609	4,570	3,209	31,179	985	176,874	6
Louisiana	28,485	11,229	1,081	34,144	28,464	186	413	3,230	16,063	1,406	12,829	6,739	74	144,248	512
Oklahoma	11,589	2,471	0	413	2,029	701	449	14,106	52,446	6,319	8,369	1,474	20	80,376	100
Texas	33,552	40,673	1,926	2,876	29,854	2,229	3,351	18,246	74,868	17,327	50,633	1,269	21	276,983	2,625
West South Central	112,756	65,232	15,061	69,218	83,972	3,155	4,213	38,162	159,986	30,122	75,030	40,661	1,099	678,528	3,243
Montana	5,260	2,736	0	0	0	20	0	0	10	15,564	2,798	10	0	24,184	684
Idaho	13,784	19,227	872	0	1,677	68	30	0	12,884	18,478	11,116	85	2	77,870	8,838
Wyoming	1,089	457	0	0	389	5	44	0	315	4,764	741	0	0	7,772	1,081
Colorado	5,493	2,168	0	0	3,776	426	661	200	1,663	14,045	3,141	170	65	31,788	1,296
New Mexico	1,466	706	0	1	3,473	33	682	0	6,891	4,938	4,010	0	0	20,200	15
Arizona	13,490	25,087	678	969	36,915	1,830	623	40	4,868	4,110	25,988	56	456	112,990	20,841
Utah	4,487	9,085	0	0	1,076	207	221	0	4,031	4,864	1,486	38	0	24,483	313
Nevada	249	405	0	12	286	29	106	0	164	844	864	3	0	2,541	5,741
Mountain	45,167	58,810	1,550	982	47,891	2,325	2,367	240	28,586	68,072	48,076	342	728	301,833	39,512
Washington	32,857	32,334	319	204	21,220	452	2,121	860	8,505	7,673	16,377	2,431	134	125,272	46,389
Oregon	23,588	36,780	698	0	10,086	425	671	280	11,774	2,886	22,128	1,436	74	110,723	14,699
California	71,079	172,220	8,521	243	187,283	4/ 220,000	54,599	1,634	81,948	11,815	56,595	1,300	4,259	667,874	486,829
Pacific	127,194	241,324	9,538	447	218,589	220,877	57,191	2,734	72,317	22,149	124,695	5,167	4,467	1,103,869	547,896
Continental U. S.	924,736	466,923	68,215	652,963	1,046,840	259,869	160,229	911,682	781,351	247,061	591,926	297,397	80,143	6,488,563	615,423
Hawaii	0	30,529	0	122	24,583	9	70	994	8,226	40	5,474	12,178	1,620	80,794	90
Puerto Rico	0	39,365	0	0	6,980	0	1	0	350	41	741	180	35	47,663	0
Alaska[5]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Territories	0	69,893	0	122	31,563	9	71	994	8,576	81	6,215	12,358	1,655	128,457	90
Total: 1953-54	924,736	536,716	68,215	653,106	1,077,633	259,868	160,300	912,676	786,927	247,142	598,141	309,755	81,818	6,616,910	615,513
1952-53	846,252	534,740	82,219	647,483	876,506	207,127	151,910	1,176,862	1,046,827	248,860	656,996	282,466	74,461	6,612,897	877,457
1951-52	799,189	486,817	42,284	661,761	572,903	198,726	145,089	1,160,080	1,224,290	225,089	704,787	248,576	73,348	6,561,019	785,080

1/ Includes materials distributed by Government agencies. Excludes lime and materials used by manufacturers in the formulation of commercial mixtures.
2/ The principal commodities are shown in Table 5, by regions.
3/ Includes colloidal phosphate, the quantity of which is shown separately, by regions, in Table 5.
4/ Estimated.
5/ Not available.

Materials

THE consumption of fertilizer materials for direct application amounted to 7,232,423 tons in 1953-54 as compared with 7,690,384 tons in 1952-53. The quantity, in 1953-54, comprised chemical nitrogen materials 3,260,403 tons, phosphate materials (including ammonium phosphates) 2,544,886 tons, natural organics 420,068 tons, potash materials (including nitrate of potash, nitrate of soda-potash, and lime-potash) 391,553 tons, and secondary and trace element materials 615,513 tons. Compared with 1952-53 there was an increase of 273,104 tons in chemical nitrogen materials, 61,031 tons in natural organics, and 34,627 tons in potash materials. Decreases of 564,749 tons and 261,974 tons were shown in phosphate materials and secondary and trace element materials, respectively. The consumption of the principal materials comprising these classes is shown by States and regions in Tables 4 and 5.

In chemical nitrogen materials the principal changes from the previous year were increases in anhydrous ammonia (from 217,182 to 350,474 tons), nitrogen solutions including aqua ammonia (from 72,917 to 191,592 tons), and ammonium nitrate (from 846,252 to 924,716 tons). Among the natural organics, the consumption of dried manures increased from 207,127 to 259,868 tons.

Of the phosphate materials, the consumption of ammonium phosphates (11-48 and 16-20 grades) increased from 226,222 to 275,931 tons, while decreases were shown for basic slag (301,537 to 195,270 tons), phosphate rock (1,176,962 to 912,676 tons), and superphosphates grading 22 percent and under (1,046,827 to 786,927 tons). The total quantity of phosphate rock used in Illinois and Missouri, the two largest consuming States, was 722,520 tons in 1953-54, compared with 954,491 tons in 1952-53. The consumption of superphosphates grading 22 percent and under was below that in 1952-53 in 42 of the 51 States and other political units; total consumption of these grades amounted to only 42.38 percent of that in 1949-50.

The 60-percent grade of potassium chloride was greatly favored over the 50-percent grade; the respective consumptions of these grades were 256,979 and 53,056 tons, as compared with 172,210 and 110,255 tons in 1952-53.

The total consumption of gypsum decreased from 837,422 tons in 1952-53 to 576,780 tons in 1953-54. The consumption in California alone decreased from 719,788 to 414,067 tons.

The weighted average primary nutrient content of the principal classes of materials consumed is given in Table 7. These averages are based on the composition and tonnage of the individual materials comprising the several classes. For materials containing only nitrogen, P_2O_5, or K_2O, the respective national averages were 30.81, 15.70 (available P_2O_5), and 54.01 percent, while the multiple-nutrient materials averaged 17.53 percent. The corresponding averages for these classes in 1952-53 were 28.54, 14.48, 51.89, and 21.96 percent. With the exception of the multiple-nutrient materials, the national averages were higher than in 1952-53. This reflects the greater use of higher analysis products. The drop in the average concentration of multiple-nutrient materials was largely the result of the increase in consumption of dried manures, which have a low content of primary nutrients.

Primary Nutrients

The quantities of primary nutrients in fertilizers are based on the average analyses of the various products

Kinds	New England	Middle Atlantic	South Atlantic	East North Central	West North Central	East South Central	West South Central	Mountain	Pacific	Territories 5/	Total
MIXTURES: N-P-K	326,687	1,728,122	4,631,903	3,315,152	990,949	1,896,386	645,286	21,844	228,880	261,090	14,060,649
N-P	94	92	1,889	2,448	271,241	72	29,082	34,048	38,795	5,717	382,982
P-K	28,282	104,656	196,184	802,829	80,824	145,956	36,808	79	2,182	2,393	694,814
N-K	0	44	195,930	715	102	461	177	21	1,940	16,216	215,631
CHEMICAL NITROGEN MATERIALS											
Ammonia, anhydrous	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	260,474
Ammonium nitrate ,	4,580	28,858	81,642	118,200	178,601	233,263	111,784	45,147	129,196	0	926,710
Ammonium nitrate-limestone mixtures	170	3,324	291,068	17,464	14,740	60,722	2,485	82	80	0	390,803
Ammonium sulfate	288	3,762	8,334	55,868	28,863	9,852	65,232	68,830	241,324	69,895	536,754
Calcium cyanamide	736	7,600	16,029	5,863	342	15,092	18,041	1,880	6,836	0	68,213
Calcium nitrate	0	0	12,361	37	40	219	0	4,647	33,297	103	50,694
Nitrogen solutions 4/	0	2,116	5,068	13,132	34,193	946	4,790	14,189	95,976	21,916	5/ 191,692
Sodium nitrate	2,882	16,116	381,848	2,173	259	179,619	69,218	962	447	122	653,106
Other 6/	329	4,252	18,008	60,909	103,850	87,253	78,997	28,708	89,214	9,374	7/ 96,270
NATURAL ORGANIC MATERIALS											
Blood, dried	0	146	80	0	0	0	0	18	1,536	0	1,776
Castor pomace	6,039	70	2,998	0	0	0	0	88	1,494	0	9,686
Compost	65	4,256	1,131	236	4,198	0	1,982	0	3	0	11,892
Cottonseed meal 8/	7,880	61	1,948	2	0	0	0	1	7	1	9,906
Fish scrap, meal, and emulsions	481	2	0	0	0	0	0	1	1,040	0	1,494
Manures, dried	4,116	10,271	3,087	10,806	3,714	1,868	3,126	2,226	220,877	9	259,868
Sewage sludge, activated	4,418	9,986	3,001	26,090	6,831	1,164	2,269	2,191	14,348	70	70,021
" " , other	0	0	0	1,236	591	0	0	0	29,017	0	30,843
Tankage, animal	0	161	10	0	0	0	0	0	311	0	482
" , garbage	0	12	9	0	0	0	0	0	0	0	21
" , process	2,598	6,817	2,089	2,701	0	8	0	0	492	0	14,803
Other 9/	684	2	320	0	0	0	76	8,926	0	0	10,277
PHOSPHATE MATERIALS											
Ammonium phosphate: 11-48	0	1	286	0	10,968	0	71	5,076	14,000	2,787	33,066
" " 16-20 10/	0	18	69	1,098	56,896	87	80,647	34,172	67,527	2,356	242,866
" " 13-39	0	0	0	260	21,023	0	4,181	2,169	4,978	0	32,671
Ammoniated superphosphate 11/	0	0	72	0	0	0	0	929	6,661	741	8,383
Basic lime phosphate	0	0	958	0	0	2,768	0	0	0	0	3,726
Basic slag	0	2,000	33,491	0	0	161,268	8,611	0	0	0	195,370
Bonemeal, raw	246	360	571	97	61	28	118	7	973	0	2,162
" , steamed	1,804	5,077	1,134	1,362	1	418	844	1	1,018	0	9,657
Calcium metaphosphate	0	90	1,861	5,628	14,869	5,355	245	140	101	0	28,289
Fused tricalcium phosphate	0	0	1,455	1,822	33	20,728	204	0	0	0	24,242
Phosphoric acid: 82-84%	0	0	0	0	0	0	38	5,561	9,647	0	15,246
Phosphate rock	613	11,127	29,386	606,379	190,822	7,940	35,700	200	2,414	994	876,575
Colloidal phosphate	0	1,200	911	10,726	9,627	13,015	2,462	40	320	0	38,301
Precipitated bone	470	0	0	0	0	0	0	0	0	0	470
Superphosphate: 16%	4,729	15,974	40,867	34,102	17,882	33,472	208	3,307	30,076	0	180,617
" 18%	3,930	10	1,146	21	262	1,008	0	18,738	40,298	0	65,417
" 20-22%	18,727	90,860	30,137	77,398	63,296	109,844	138,776	6,644	1,963	5,876	540,895
" 23-41%	0	211	0	382	2,572	26	2,781	920	55	0	6,947
" 42-44%	0	0	0	0	25,863	0	0	35,699	10,188	0	71,320
" 45%	0	206	70	16,621	36,403	1,327	23,316	9,898	3,897	1	89,336
" 46%	0	29	280	1,774	13,798	1,224	412	16,951	6,454	80	41,008
" 47%	39	66	99	812	14,867	6,832	496	2,832	886	0	27,526
" 48%	0	0	361	1,765	1,840	1,143	786	77	1,290	0	7,262
" 49-50%	0	24	0	684	451	161	2,332	96	0	0	3,747
Other 12/	0	0	1,168	0	180	0	801	31	2	322	2,184
POTASH MATERIALS											
Cotton hull ashes	869	8	52	0	0	0	0	0	0	0	949
Lime-potash mixtures: 5-10 13/	0	1,945	21,040	0	0	2,700	0	0	0	0	25,685
Manure salts: 20-30%	0	8	1,714	173	800	4	646	0	0	0	2,946
Potassium carbonate	0	0	154	0	0	0	0	0	0	0	154
Potassium chloride: 50%	34	187	21,208	6,567	1,798	11,389	10,061	731	993	800	53,056
" 60%	1,909	3,629	23,127	113,969	26,329	41,383	30,610	311	4,174	11,538	256,979
" magnesium sulfate	146	245	5,299	1,971	848	982	491	0	8	8	7,961
" nitrate	188	7	0	0	0	0	0	0	0	0	195
" phosphate ash 13/	0	0	0	0	0	12	0	0	0	0	12
" sodium nitrate 13/	19	0	11,045	0	0	596	40	180	0	0	11,880
" sulfate	89	563	7,008	911	2	10,469	22	545	4,459	1,682	25,740
Tobacco stems	0	18	527	0	0	1	0	0	0	0	543
Wood ashes	0	0	5,456	0	0	0	0	0	0	0	5,456
TOTAL PRIMARY NUTRIENT FERTILIZERS	416,200	2,064,522	6,074,730	4,819,761	2,222,996	3,022,327	1,301,685	387,726	1,576,742	411,870	22,157,956
SECONDARY & TRACE ELEMENT MATERIALS 8/											
Aluminum sulfate	4	13	0	1	0	3	0	0	88	0	109
Borax	82	267	215	339	6	538	5	0	544	0	2,996
Calcium sulfate (gypsum)	406	3,241	68,186	1,865	1,241	967	1,200	19,204	472,471	0	575,780
Copper sulfate	0	56	170	166	0	2	0	2	184	0	550
Ferrous sulfate	0	0	19	2	0	0	0	64	519	0	602
Magnesium carbonate	0	0	0	0	0	0	0	0	6,122	0	6,122
" sulfate	19	188	1,041	23	0	0	0	6	119	14	1,379
Manganese sulfate	26	136	126	428	0	4	0	0	83	0	803
Mixed Minerals	0	144	11	3	0	6	21	79	2,717	0	2,981
Sulfur: 25-99+%	10	160	122	28	0	1	2,017	5,414	13,489	0	19,221
Sulfuric acid: 60-93%	0	0	0	0	0	0	0	741	2,198	0	3,039
Zinc sulfate	0	28	80	2	0	51	0	2	1,992	76	2,231
TOTAL SECONDARY & TRACE ELM. MAT.	546	4,183	68,368	2,857	1,247	1,572	3,243	25,512	497,895	90	615,513
TOTAL ALL FERTILIZERS	416,746	2,068,706	6,143,098	4,822,618	2,224,242	3,023,899	1,304,928	393,137	1,974,637	411,960	22,773,469

as published by fertilizer control officials for the State in which they were consumed, rather than on the manufacturers' guarantees. Thus, the overruns or underruns of nutrients from the guarantees are taken into account. This gives more nearly the actual tonnages of nutrients than would be the case if only the guarantees were used. The actual nutrient content usually averages somewhat higher than the guarantee.

Fertilizers consumed in the United States and Territories in 1953-54 contained 1,847,416 tons of nitrogen, 2,242,100 tons of available P_2O_5 (2,646,971 tons of total P_2O_5), and 1,806,042 tons of K_2O (Table 6). Compared with 1952-53, the quantity of nitrogen increased 210,360 tons (12.85 percent) and of K_2O 67,792 tons (3.90 percent), while available P_2O_5 and total P_2O_5 decreased 28,650 tons (1.26 percent) and 118,317 tons (4.28 percent), respectively.

The annual consumption of primary nutrients in the United States and Territories for the years 1943-44 to 1953-54 is shown in Figure 1. During the period 1945-46 to 1949-50 the consumption of nitrogen increased at the rate of approximately 75,000 tons annually, whereas the annual rate of increase in subsequent years was about 210,000. In general, the consumption of K_2O has paralleled that of nitrogen, but with a decreasing trend in the annual rate of increase since 1950-51. It will be noted that in 1953-54 the consumption of K_2O was lower than that of nitrogen for the first time during the period 1943-44 to 1953-54. Also for the first time during this period, the consumption of available P_2O_5 took a downward turn in 1953-54.

The quantities and proportions of the nutrients consumed as mixed fertilizers in 1953-54 were 778,099 tons (42.12 percent) for nitrogen, 1,801,423 tons (80.35 percent) for available P_2O_5, 1,930,260 tons (72.92 percent) for total P_2O_5, and 1,596,032 tons (88.37 percent) for K_2O. The quantities of nitrogen, available P_2O_5, total P_2O_5, and K_2O consumed as mixed fertilizers were, respectively, 6.87, 1.07, 0.51, and 2.83 percent greater than in 1952-53.

The quantities and proportions of the nutrients consumed as fertilizer materials in 1953-54 were 1,069,317 tons (57.88 percent) for nitrogen, 440,677 tons (19.65 percent) for available P_2O_5, 716,711 tons (27.08 percent) for total P_2O_5, and 210,010 tons (11.63 percent) for K_2O. The quantities of nitrogen and K_2O consumed as materials were, respectively, 17.64 and 12.78 percent greater than in 1952-53, while the quantities of available P_2O_5 and total P_2O_5 were, respectively, 9.78 and 15.16 percent less.

TABLE 5

Kinds of Fertilizers Consumed in Regions of the United States, in Tons, During the Year Ended June 30, 1954[1]

[1]Includes distribution by government agencies. Does not include the quantities of materials used for manufacture of commercial mixtures. [2]Excludes Alaska as data was not available. [3]Included with "Other Chemical Nitrogen Materials." Regional data cannot be published without disclosing operations of individual suppliers. [4]Includes aqua ammonia. [5]Contains 26.83 per cent nitrogen. [6]Anhydrous ammonia, ammonium sulfate-nitrate-urea, and chemical nitrogen materials not classified. [7]Does not include above total for anhydrous ammonia. [8]Excludes materials distributed by other than manufacturers of fertilizers. [9]Meals: Crab (2), Hoof and Horn (475), Linseed (588), Lupine (56), Seed (818), Soybean (219), Tung (166), Vegetable (98); Peat (23)[10]; and organics not classified 8,242 tons. [10]Includes quantities reported as 16-20-0 mixture. [11]Additional quantities may have been reported as mixed grades. [12]Not Classified. [13]Includes cement flue dust. Additional quantities are given free to farmers for which no records are kept.

TONS

State & Region	In Mixtures					In All Fertilizers				
	Nitrogen	P_2O_5 Available	P_2O_5 Total	K_2O	Total N, Avail. P_2O_5, & K_2O	Nitrogen	P_2O_5 Available[2/]	P_2O_5 Total[2/]	K_2O	Total N, Avail. P_2O_5, & K_2O
Maine	11,046	17,676	18,586	20,397	49,019	11,620	18,471	19,306	20,436	50,526
New Hampshire	626	1,427	1,615	1,855	3,908	1,021	1,873	1,987	1,604	4,498
Vermont	1,191	3,666	3,795	4,953	9,809	1,414	5,740	6,084	5,099	12,243
Massachusetts	4,044	6,469	6,762	6,511	17,024	5,189	7,606	8,003	6,881	19,676
Rhode Island	736	1,340	1,419	1,356	3,432	889	1,468	1,504	1,410	3,767
Connecticut	3,744	5,678	6,041	6,209	15,661	5,110	7,394	7,863	7,852	20,056
New England	21,407	36,186	37,904	40,979	98,541	25,243	42,551	44,776	42,971	110,766
New York	29,866	57,826	60,410	46,812	133,603	37,290	69,196	72,896	47,411	153,897
New Jersey	14,027	27,761	29,172	28,904	68,362	16,748	29,350	31,136	27,676	73,650
Pennsylvania	28,376	72,700	76,579	62,683	163,761	32,046	81,268	86,554	63,567	176,661
Delaware	4,502	9,948	10,266	10,016	24,163	6,800	10,081	10,841	10,219	28,100
District of Columbia	110	162	196	123	415	154	252	266	129	536
Maryland	12,688	33,063	36,172	26,189	73,930	14,812	34,526	37,169	28,491	77,829
West Virginia	2,689	6,396	9,100	6,312	17,399	3,452	9,372	10,244	6,359	19,183
Middle Atlantic	91,459	209,756	219,894	180,439	481,653	110,299	234,015	248,906	183,841	527,955
Virginia	24,285	75,386	80,492	69,666	169,305	37,246	78,147	84,336	71,976	187,369
North Carolina	59,297	141,628	152,710	125,648	326,573	115,840	146,514	158,331	133,617	396,971
South Carolina	25,516	66,678	71,896	56,492	148,483	68,063	71,664	77,210	68,673	208,420
Georgia	44,868	104,990	115,436	99,478	249,325	68,800	110,421	119,377	106,374	305,296
Florida	56,780	82,118	97,566	78,916	219,813	72,578	84,869	106,554	82,536	240,260
South Atlantic	212,541	470,787	518,790	430,199	1,113,497	362,224	491,615	545,587	463,076	1,336,936
Ohio	41,661	130,336	139,462	129,078	301,075	65,325	136,607	147,766	130,873	319,805
Indiana	44,500	140,821	149,818	150,486	336,777	74,504	148,071	156,002	152,423	384,998
Illinois	32,913	84,799	90,297	94,486	212,198	62,166	124,109	295,239	161,955	350,250
Michigan	22,560	76,413	81,183	76,467	174,240	30,831	79,806	85,389	76,464	196,800
Wisconsin	14,617	58,816	62,200	69,213	142,246	19,736	58,755	67,088	71,803	161,294
East North Central	155,251	490,985	522,960	519,700	1,166,536	260,860	547,047	786,484	593,518	1,401,126
Minnesota	12,187	60,726	65,084	56,724	99,637	24,202	64,681	69,089	57,856	126,639
Iowa	28,764	75,396	79,621	41,585	145,645	76,119	102,396	112,932	45,625	224,042
Missouri	33,281	70,106	75,728	82,470	186,856	72,823	80,929	132,582	64,226	217,678
North Dakota	1,663	6,191	6,496	1,266	9,110	2,924	16,841	17,186	1,275	20,740
South Dakota	1,226	2,779	2,991	208	4,315	4,311	6,579	6,956	217	11,107
Nebraska	7,452	13,371	13,880	1,583	22,406	52,696	25,172	27,009	1,698	79,566
Kansas	9,719	20,244	21,431	3,496	33,458	33,262	41,990	45,782	3,979	79,151
West North Central	94,282	238,813	251,881	187,181	470,325	266,087	338,590	411,306	184,476	768,903
Kentucky	19,200	50,528	55,424	48,156	117,906	31,908	66,569	74,329	57,961	156,458
Tennessee	16,832	44,372	47,923	38,615	99,819	38,744	55,664	60,867	46,066	140,464
Alabama	35,282	84,499	91,306	63,745	183,526	80,634	101,709	110,925	70,288	252,628
Mississippi	20,334	33,797	36,423	26,795	80,924	112,299	46,670	65,886	29,656	200,405
East South Central	91,648	213,196	230,976	177,311	482,155	263,586	272,522	299,027	213,868	749,976
Arkansas	10,648	21,210	22,644	22,690	54,548	82,102	27,610	29,687	41,046	120,687
Louisiana	10,973	19,922	21,214	16,689	46,584	49,574	25,902	28,299	19,574	94,050
Oklahoma	4,136	9,368	9,849	5,866	17,392	11,436	21,416	25,764	4,799	37,649
Texas	17,766	35,174	37,064	18,771	71,700	68,660	70,142	77,942	19,623	188,424
West South Central	43,512	85,674	90,771	61,016	190,224	181,780	144,869	161,692	85,041	411,690
Montana	397	899	996	42	1,538	3,141	8,027	8,578	49	11,217
Idaho	701	928	986	156	1,765	12,494	14,996	16,070	191	27,681
Wyoming	267	554	612	44	865	1,097	3,011	3,092	44	4,152
Colorado	1,632	3,286	3,580	630	5,448	7,008	11,719	11,989	690	19,404
New Mexico	246	322	341	49	617	4,088	4,567	4,704	54	8,707
Arizona	2,686	3,241	3,563	627	6,454	32,496	12,336	12,661	956	45,789
Utah	300	570	598	107	977	4,580	3,960	4,095	154	8,674
Nevada	68	109	115	37	214	414	846	868	40	1,000
Mountain	6,197	9,937	10,341	1,572	17,706	65,312	59,164	61,636	2,148	126,624
Washington	2,087	3,944	4,089	3,187	9,168	36,243	13,704	14,297	4,709	54,656
Oregon	2,080	3,382	3,608	2,109	7,811	28,940	12,334	12,868	3,028	41,002
California	23,868	22,087	22,973	12,294	58,169	172,966	66,716	69,194	20,300	258,980
Pacific	27,916	29,363	30,671	17,590	74,868	236,848	91,755	96,359	28,037	354,638
Continental U. S.	746,012	1,784,534	1,911,197	1,864,989	4,094,506	1,789,889	2,221,946	2,624,291	1,786,676	5,778,810
Hawaii	6,180	5,269	5,784	9,354	20,785	20,964	8,324	9,160	17,513	46,801
Puerto Rico	26,907	11,620	13,309	21,739	60,266	26,864	11,850	13,520	21,853	70,247
Alaska[4/]	---	---	---	---	---	---	---	---	---	---
Territories	33,087	16,889	19,093	31,073	81,049	47,828	20,154	22,680	39,366	117,048
Total: 1953-54	778,099	1,801,423	1,930,290	1,896,062	4,175,554	1,847,416	2,242,100	2,646,971	1,826,042	5,895,858
1952-53[5/]	728,098	1,782,286	1,920,472	1,862,041	4,062,422	1,637,066	2,270,750	2,766,288	1,736,250	5,646,066
1951-52	648,223	1,680,706	1,806,823	1,420,598	3,749,323	1,423,160	2,199,378	2,676,070	1,681,467	5,308,008

TABLE 6a

Consumption of Primary Plant Nutrients in Fertilizer. Year Ended June 30, 1954[1]

[1]Includes government distribution. [2]Includes, as available P_2O_5, 2 per cent of the colloidal phosphate and 3 per cent of the phosphate rock marketed for direct application. [3]Includes, as total P_2O_5, 22 per cent of the colloidal phosphate and 32 per cent of the phosphate rock marketed for direct application. [4]Not available. In 1952-53, total primary plant nutrients in all fertilizers amounted to 273 tons. [5]Revised. Excess quantities of 1,960 tons of K_2 mixtures in Kansas and 2,702 tons of total P_2O_5 in all fertilizers in Idaho were reported for 1952-53.

The total primary nutrient content of mixed fertilizers consumed in 1953-54 amounted to 4,175,554 tons, or 2.78 percent more than the consumption (4,062,422 tons) in 1952-53. The total primary nutrient content of fertilizer materials in 1953-54 was 1,720,004 tons, or 8.61 percent more than that (1,583,634 tons) in 1952-53.

The 1953-54 consumption of fertilizer materials containing primary nutrients was 195,987 tons (2.88 percent) less than in 1952-53. The consumption of all fertilizers (materials and mixtures) containing primary nutrients was 1.67 percent below the 1952-53 level, whereas the total quantity of primary nutrients supplied by these fertilizers increased 4.42 percent.

The percentage change in consumption of primary nutrients in 1953-54 as compared with 1952-53 is shown by States and other political units in Figure 2. Percentage increases in nitrogen were generally highest in the West North Central and the West South Central States. These regions consumed 17.72 percent of the total primary nutrients in mixed fertilizers and 28.98 percent of the total in materials (Table 6a). The percentage change in nitrogen consumption ranged from a decrease of 13.08 percent in Maine to an increase of 117.18 percent in South Dakota. Wide variations are also shown in the percentage changes in the consumption of P_2O_5 and K_2O.

Table 6a.—Regional Distribution of Consumption of Primary Nutrients, as Percentages of Respective Totals in Mixtures and Materials, Year Ended June 30, 1954.

Region	N		Available P_2O_5		K_2O	
	Mixtures	Materials	Mixtures	Materials	Mixtures	Materials
New England	2.75	0.36	2.01	1.45	2.57	0.95
Middle Atlantic	11.75	1.76	11.64	5.51	11.31	1.48
South Atlantic	27.32	15.87	26.13	4.74	26.95	15.65
East No. Cent.	20.04	9.78	27.25	12.74	32.50	35.63
West No. Cent.	12.13	16.05	13.26	22.60	8.59	8.26
East So. Cent.	11.78	16.08	11.83	13.46	11.11	17.41
West So. Cent.	5.59	12.93	4.76	13.43	3.82	11.43
Mountain	0.80	5.53	0.55	11.17	0.10	0.27
Pacific	3.59	19.35	1.63	14.16	1.10	4.97
Territories	4.25	2.29	0.94	0.74	1.95	3.95
U. S.	100.00	100.00	100.00	100.00	100.00	100.00

Table 7. - Weighted Average Content of Primary Plant Nutrients in Fertilizers in Percent, Year Ended June 30, 1954[1]

State & Region	Mixtures[2]				Materials					Total Nutrients in Mixtures and Materials
					Single Nutrient[3]			Multiple Nutrients[2]	Total Nutrients	
	N	Available P_2O_5	K_2O	Total Nutrients	N	Available P_2O_5[4]	K_2O			
Maine	6.70	10.67	12.38	29.75	26.61	19.91	53.42	12.23	21.67	29.43
New Hampshire	5.29	12.07	13.13	30.49	29.54	20.35	65.86	10.41	22.43	28.47
Vermont	4.32	13.30	17.97	35.59	28.44	21.28	60.87	13.87	22.44	31.87
Massachusetts	5.85	9.36	9.42	24.63	16.76	18.46	60.38	11.29	16.82	23.18
Rhode Island	6.47	9.96	10.08	26.51	17.53	17.86	59.07	11.98	16.82	24.39
Connecticut	5.77	8.71	9.52	24.00	21.33	22.21	56.45	13.07	17.79	22.29
New England	6.08	10.27	11.64	27.99	22.73	20.66	57.69	12.48	19.01	26.61
New York	5.70	11.27	9.06	26.03	25.92	20.01	55.02	10.06	21.28	25.29
New Jersey	5.27	10.43	10.00	25.70	24.14	17.01	57.07	11.38	21.32	25.33
Pennsylvania	4.67	11.96	10.31	26.93	25.06	17.35	57.07	10.08	18.37	26.04
Delaware	4.85	11.09	11.28	27.22	34.49	22.89	59.82	9.06	32.35	27.84
District of Columbia	5.77	9.54	6.45	21.76	13.37	35.09	60.56	13.02	16.18	19.85
Maryland	4.34	11.32	9.65	25.31	24.66	16.83	12.65	12.08	19.27	24.92
West Virginia	3.96	12.38	9.30	25.64	21.62	19.22	59.74	9.92	19.18	24.86
Middle Atlantic	4.98	11.41	9.82	26.21	25.63	18.61	41.52	10.47	20.39	25.87
Virginia	5.84	11.00	10.17	24.71	19.91	18.43	14.05	10.13	18.53	23.94
North Carolina	3.98	9.50	8.43	21.91	19.96	16.18	37.38	11.62	20.67	21.68
South Carolina	3.77	9.92	8.41	22.10	20.10	16.22	53.21	20.26	22.60	22.21
Georgia	4.07	9.52	9.02	22.61	22.11	16.02	54.53	19.77	22.86	22.65
Florida	5.49	7.66	7.36	20.51	22.09	9.02	42.35	15.46	18.58	20.33
South Atlantic	4.23	9.37	8.87	22.17	20.66	14.99	40.16	15.63	21.22	22.01
Ohio	4.09	12.80	12.68	29.57	32.45	16.80	49.15	10.91	24.80	29.24
Indiana	4.34	13.76	14.69	32.78	36.07	14.19	58.58	9.99	31.52	32.62
Illinois	5.21	13.43	14.96	33.60	40.34	5.97	61.40	11.23	16.71	23.80
Michigan	4.10	14.01	13.84	31.95	31.94	16.62	51.37	9.11	23.13	31.16
Wisconsin	5.61	14.55	17.21	38.37	37.38	6.56	56.52	9.74	23.30	34.31
East North Central	4.31	13.56	14.32	32.19	37.17	7.16	60.22	10.28	19.65	29.07
Minnesota	4.84	20.16	14.60	39.60	46.45	34.11	59.44	28.97	38.06	39.27
Iowa	6.83	17.91	9.83	34.57	42.53	21.32	57.89	38.42	33.95	34.36
Missouri	7.10	14.96	11.19	33.25	44.27	5.74	58.33	23.27	21.48	28.77
North Dakota	7.17	26.85	5.49	39.51	33.17	45.36	60.80	81.78	47.28	43.52
South Dakota	9.90	20.74	1.56	32.19	44.89	39.69	55.10	37.62	40.91	37.01
Nebraska	11.30	20.28	2.40	33.98	47.29	33.46	60.50	33.23	43.11	40.08
Kansas	9.76	20.33	3.51	33.60	41.99	33.02	57.38	41.93	39.30	36.67
West North Central	7.08	17.78	10.21	35.02	44.35	18.85	58.26	38.50	32.80	34.14
Kentucky	4.24	11.16	10.64	26.04	32.69	22.56	53.73	7.99	29.97	26.91
Tennessee	4.26	11.23	9.77	25.26	32.74	24.93	49.30	14.60	31.63	26.82
Alabama	4.21	10.09	7.61	21.91	22.69	12.87	59.27	13.61	20.03	21.36
Mississippi	5.74	9.54	7.56	22.84	36.66	13.83	56.04	30.65	31.42	27.28
East South Central	4.49	10.45	8.69	23.63	30.89	16.62	54.43	13.94	27.26	24.81
Arkansas	5.49	10.94	11.71	28.14	34.64	23.52	57.07	37.80	37.38	32.55
Louisiana	6.33	11.49	9.05	26.87	36.61	16.78	57.20	34.45	33.52	29.89
Oklahoma	6.41	14.52	6.03	26.96	36.25	18.96	59.44	35.64	25.20	25.98
Texas	6.31	12.50	6.97	25.48	39.46	21.29	59.22	34.87	31.31	28.37
West South Central	6.10	12.01	8.56	26.67	36.89	20.37	57.24	35.04	32.64	29.68
Montana	9.38	21.23	0.99	31.60	29.17	47.33	60.50	43.18	40.70	39.47
Idaho	10.33	13.64	2.00	25.97	28.91	34.31	61.39	44.66	33.37	32.78
Wyoming	11.22	24.55	1.85	37.62	37.49	44.44	0	35.62	41.91	40.90
Colorado	11.11	22.37	3.61	37.09	46.26	44.41	59.15	13.82	43.91	41.75
New Mexico	11.46	15.00	2.28	28.74	56.18	32.77	0	35.91	40.05	38.98
Arizona	12.06	16.10	2.92	30.07	34.46	35.90	60.36	35.21	34.94	34.08
Utah	8.28	15.74	2.95	26.97	29.62	33.71	60.50	33.32	31.44	30.87
Nevada	7.79	12.48	4.24	24.51	23.53	36.69	60.50	33.25	30.93	29.29
Mountain	11.03	17.68	2.90	31.61	34.14	38.48	54.34	37.26	36.12	35.40
Washington	8.87	13.31	10.76	30.94	36.64	31.48	58.87	36.35	36.31	35.28
Oregon	9.19	15.39	9.59	34.17	28.37	24.49	59.97	37.80	30.25	30.90
California	10.78	9.96	5.56	26.30	30.61	26.69	52.61	12.87	23.14	23.78
Pacific	10.23	10.76	6.45	27.44	31.16	27.18	55.37	15.41	25.34	25.76
Continental U. S.	4.88	11.70	10.26	26.84	31.06	15.89	53.80	17.32	26.96	26.57
Hawaii	10.44	8.91	15.78	35.13	26.52	18.47	59.28	48.59	32.20	33.44
Puerto Rico	12.02	5.19	9.71	26.92	20.80	23.22	58.68	21.96	20.99	25.88
Alaska[5]	---	---	---	---	---	---	---	---	---	---
Territories	11.69	5.97	10.98	28.64	23.36	18.73	59.27	45.29	28.06	28.45
U. S. Average:										
1953-54	5.01	11.69	10.27	26.87	30.81	15.70	54.01	17.53	25.99	26.61
1952-53	4.63	11.34	9.87[6]	25.84[6]	28.54	14.48	51.89	21.96	23.24	25.06[6]
1951-52	4.30	11.14	9.42	24.86	27.96	14.71	49.98	20.97	22.16	24.04

1/ Excludes materials not guaranteed to contain N, P_2O_5, or K_2O.
2/ Guaranteed to contain two or more of the primary plant nutrients, N, P_2O_5, or K_2O.
3/ Guaranteed to contain only one of the primary plant nutrients.
4/ Includes the available P_2O_5 content of colloidal phosphate and phosphate rock as 2 percent and 3 percent, respectively.
5/ Not available.
6/ Revised.

SYSTOX*

on

COTTON

for control of aphids and mites

* REGISTERED TRADEMARK OF CHEMAGRO CORPORATION

CHEMAGRO CORPORATION

101 PARK AVENUE, NEW YORK, N. Y.

more and more
granulated
fertilizer manufacturers
are turning to

LOUISVILLE / **rotary dryers**
rotary coolers

to speed production . . .
reduce drying costs

Installations are individually engineered for your problems. Results can be pre-determined in our pilot plant. We'll be glad to show you how the fertilizer industry has found a new way to efficient and profitable drying.

A Louisville engineer will survey your present operation without obligation on your part. Take advantage of Louisville's equipment and experience. Phone or write today.

LOUISVILLE DRYING MACHINERY UNIT
GENERAL AMERICAN TRANSPORTATION CORPORATION
Dryer Sales Offices: 139 So. Fourth Street, Louisville 2, Kentucky • 380 Madison Ave., New York 17, New York
General Offices: 135 So. LaSalle Street, Chicago 90, Illinois
In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario
OFFICES IN ALL PRINCIPAL CITIES

Three of the A.A.C. Co's electrically-operated draglines at work at our phosphate mines in Central Florida. Bucket capacities range from 9½ to 17 cubic yards. The 17-yard draglines with their 175-foot booms each weigh more than a million and a half pounds and can move 35,000 tons of material in 24 hours. From these rock deposits flow a continuous stream of high quality phosphate rock, assuring a dependable source of supply of AA QUALITY phosphorus products, see list below.

AA Quality...

for over 85 years a symbol of quality and reliability

From the air—wet rock storage and drying plant, with dry rock storage silos in background. These silos, 29 in number, have a total capacity of 40,000 tons of dried rock. Under the silos are four runways where 40 railroad cars can be loaded at a time.

principal AA QUALITY products

All grades of Florida Pebble Phosphate Rock
AA QUALITY Ground Phosphate Rock
All grades of Complete Fertilizers **Superphosphate**
Gelatin **Bone Products** **Salt Cake** **Ammonium Carbonate**
Sulphuric Acid **Fluosilicates** **Insecticides and Fungicides**
Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY

GENERAL OFFICE: 50 CHURCH STREET, NEW YORK 7, N. Y.

30 FACTORIES AND SALES OFFICES, SERVING U.S., CANADA AND CUBA—ASSURE DEPENDABLE SERVICE

Whatever the amount of toxicant in your concentrate... there's a matched ATLOX® emulsifier!

An emulsifier that is O.K. in concentrates having 5 pounds of toxicant per gallon may not work at 8 pounds per gallon. Simply increasing the amount of emulsifier is not always the best or most economical answer. For best results, an emulsifier should be *matched* to the amount of toxicant . . . the solvent . . . and other vital factors listed in the table below.

In our years of experience with leading formulators, we have developed a comprehensive line of Atlox emulsifiers . . . and extensive knowledge on how to apply them most effectively. Just fill out the "Emulsion Data Check List" . . . send it to us . . . or ask a technical representative to call. We'll be glad to recommend an Atlox emulsifier or blend that matches *your* formula to perfection.

EMULSION DATA CHECK LIST

1. Toxicant used_____
2. Solvent used_____
3. For water hardness_____ ppm.
4. Recommended dilution_____
5. Lbs. toxicant/gal. of concentrate_____
6. Desired emulsion stability_____
7. Shelf life expected_____
8. Ease of dispersion important?_____
9. Packaging: bulk_____ or small container_____
10. How is concentrate mixed and evaluated in laboratory tests?_____

CHEMICALS DEPARTMENT

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

ATLAS POWDER COMPANY, CANADA, LTD.
BRANTFORD, CANADA

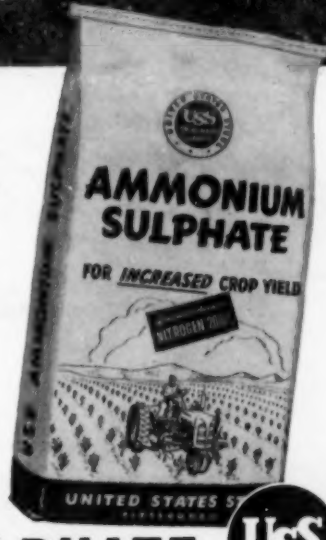
NOW is the time to sell
USS Ammonium Sulphate
. . . for emergency summer pastures

● A heavy nitrogen application is essential for good results from Sudan grass, millets and other emergency summer crops. This will bring a big demand for USS Ammonium Sulphate.

A top dress of 300 pounds per acre of USS Ammonium Sulphate at seeding time will promote quick growth of heavy grass sods, rich in protein. Point out that nitrogen on pastures has often doubled forage yields! Nitrogen helps grasses utilize available moisture better, too.

And, for even more sales, remind farmers that *additional* top dress with 200 pounds per acre of USS Ammonium Sulphate after their first grazing will give them fast regrowth for a good *second or third* grazing before frost comes. Regrowth will be uniformly lush. We are giving farmers this same message over radio in many areas.

USS Ammonium Sulphate is the ideal nitrogen source for farmers' summer pasture top dress. It is dry and free-flowing . . . less corrosive than other nitrogen materials. Stock up right away for this important summer market for USS Ammonium Sulphate.



USS AMMONIUM SULPHATE

UNITED STATES STEEL

FLY FLAKES

kills 'em fast ...and easy!

merely 1 scatter by hand

watch 2 'em die

sweep 3 'em up

The new, improved FLY FLAKES

- *Kill flies in minutes*
- *Kill resistant strains*
- *Kill maggots*
- *Are economical-to-use*
- *For dairy barns, feed rooms, poultry houses, manure piles, outside areas.*

FLY FLAKES, outstanding last year, are even more potent this year. The new, improved FLY FLAKES are the simplest, most effective and yet the most economical control devised.

Available in 1 lb. cans, 2, 5 and 10 lb. bags, and 25 lb. drums

"FLY FLAKES" is a Trade Mark

OLIN MATHIESON CHEMICAL CORPORATION

Insecticides Division

ONE PARK AVE., N.Y. N.Y. • BALTIMORE 3, MD. • LITTLE ROCK, ARK.

New MFA Concentrated* Fertilizer Plant Now On Stream...

***Based on diammonium phosphate**

Missouri Farmers Association, one of the nation's largest farm cooperatives, is now producing 200 tons per day of high analysis fertilizers at this new plant near Joplin, Mo. First to produce complete granular fertilizers for its members, MFA selected Dorr-Oliver as architects-engineers for this new project. And D-O engineers delivered by bringing the plant into full production just a little over three months after the first raw materials left the feeder bins!

Using the Dorrco Continuous Granular Fertilizer Process, the plant produces a variety of complete mixtures, all based on diammonium phosphate. Included are 14-14-14, 14-28-14 . . . and 12-36-12, the highest analysis complete fertilizer ever produced for general farm use.

If you are considering entering the fast-growing chemical fertilizer field — or if you plan to expand present facilities — it will pay to check with Dorr-Oliver.

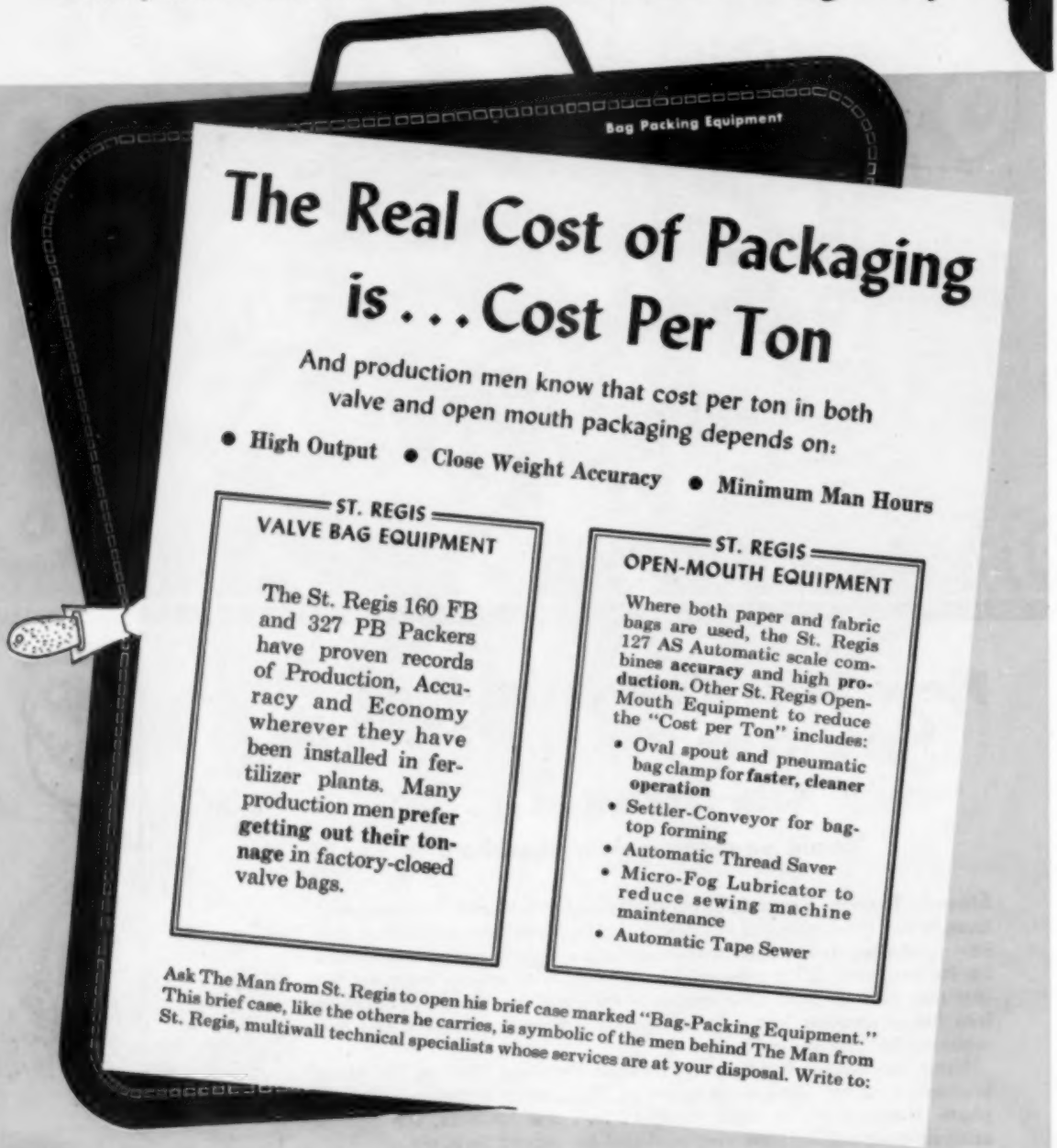
Free-flowing granules . . .

important characteristic of high analysis chemical fertilizers produced by Dorr-Oliver designed plants.

Write for Bulletin #8000, or better still, let us send an engineer to discuss your problem from the standpoint of economics and process. No obligation, of course.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

The Men behind The Man from St. Regis *say:*



The Real Cost of Packaging is . . . Cost Per Ton

And production men know that cost per ton in both valve and open mouth packaging depends on:

● **High Output** ● **Close Weight Accuracy** ● **Minimum Man Hours**

ST. REGIS
VALVE BAG EQUIPMENT

The St. Regis 160 FB and 327 PB Packers have proven records of Production, Accuracy and Economy wherever they have been installed in fertilizer plants. Many production men **prefer getting out their tonnage** in factory-closed valve bags.

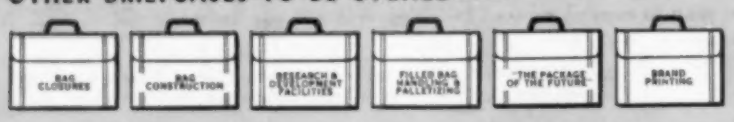
ST. REGIS
OPEN-MOUTH EQUIPMENT

Where both paper and fabric bags are used, the St. Regis 127 AS Automatic scale combines **accuracy** and high **production.** Other St. Regis Open-Mouth Equipment to reduce the "Cost per Ton" includes:

- Oval spout and pneumatic bag clamp for **faster, cleaner operation**
- Settler-Conveyor for bag-top forming
- Automatic Thread Saver
- Micro-Fog Lubricator to reduce sewing machine maintenance
- Automatic Tape Sewer

Ask The Man from St. Regis to open his brief case marked "Bag-Packing Equipment." This brief case, like the others he carries, is symbolic of the men behind The Man from St. Regis, multiwall technical specialists whose services are at your disposal. Write to:

OTHER BRIEFCASES TO BE OPENED—



MULTIWALL PACKAGING DIVISION

ST. REGIS PAPER COMPANY

Sales Subsidiary—St. Regis Sales Corporation, 230 Park Avenue, New York 17, N. Y.

The Big News in Agricultural Chemicals

...is the increased trend to combined formulation of PESTICIDE FERTILIZER MIXTURES!

And The Latest Development In Carriers is TERRA-LITE® VERMICULITE

the amazing lightweight vehicle that turns liquid chemicals into free-flowing solids

Over the years, TERRA-LITE VERMICULITE has established itself as a superior fertilizer conditioner because of its remarkable properties for being lightweight, amazingly absorbent—and the fact that it helps prevent caking and maintain flowability.

Its use, too, as a carrier for chlordane and other chemicals for controlling soil pests and weeds is gaining wide recognition.

The citrus industry has discovered, and now widely accepts VERMICULITE as being an excellent carrier for iron chelates.

A new use of vermiculite is typified in the trend to the formulation of pesticide fertilizer mixtures—*controlling soil pests by the addition of granular insecticides to fertilizer!*

These uses are typical of the growing and significant trend to vermiculite, and today Agriculture continues to experiment and establish new uses of vermiculite as a chemical carrier.

If you have any type of agricultural chemical problem with relation to carrier-conditioners, chances are Terra-Lite vermiculite can serve you well. We will be glad, of course, to send you free samples and descriptive literature about the new free-flowing carrier-conditioner—TERRA-LITE vermiculite. Just mail coupon.

- ★ **Free-flowing even when mixed with a high percentage of chemicals.**
- ★ **Over 27,500,000 particles per pound, (28/65 mesh).**
- ★ **Blends well with mixed fertilizers.**
- ★ **Low Cost per unit of insecticide per ton of fertilizer.**
- ★ **Has remarkably low reactivity with chlorinated hydro-carbons.**
- ★ **Quick service from over 40 plants.**

Terra-Lite® BRAND VERMICULITE

Terra-Lite®
Division Zonolite Company
135 S. La Salle St., Chicago 3, Illinois

SEND COUPON TODAY

Terra-Lite, Dept. AC-65
Division Zonolite Company
135 S. La Salle St., Chicago 3, Illinois

Please rush me free working sample and descriptive literature about the new free-flowing carrier, Terra-Lite VERMICULITE.

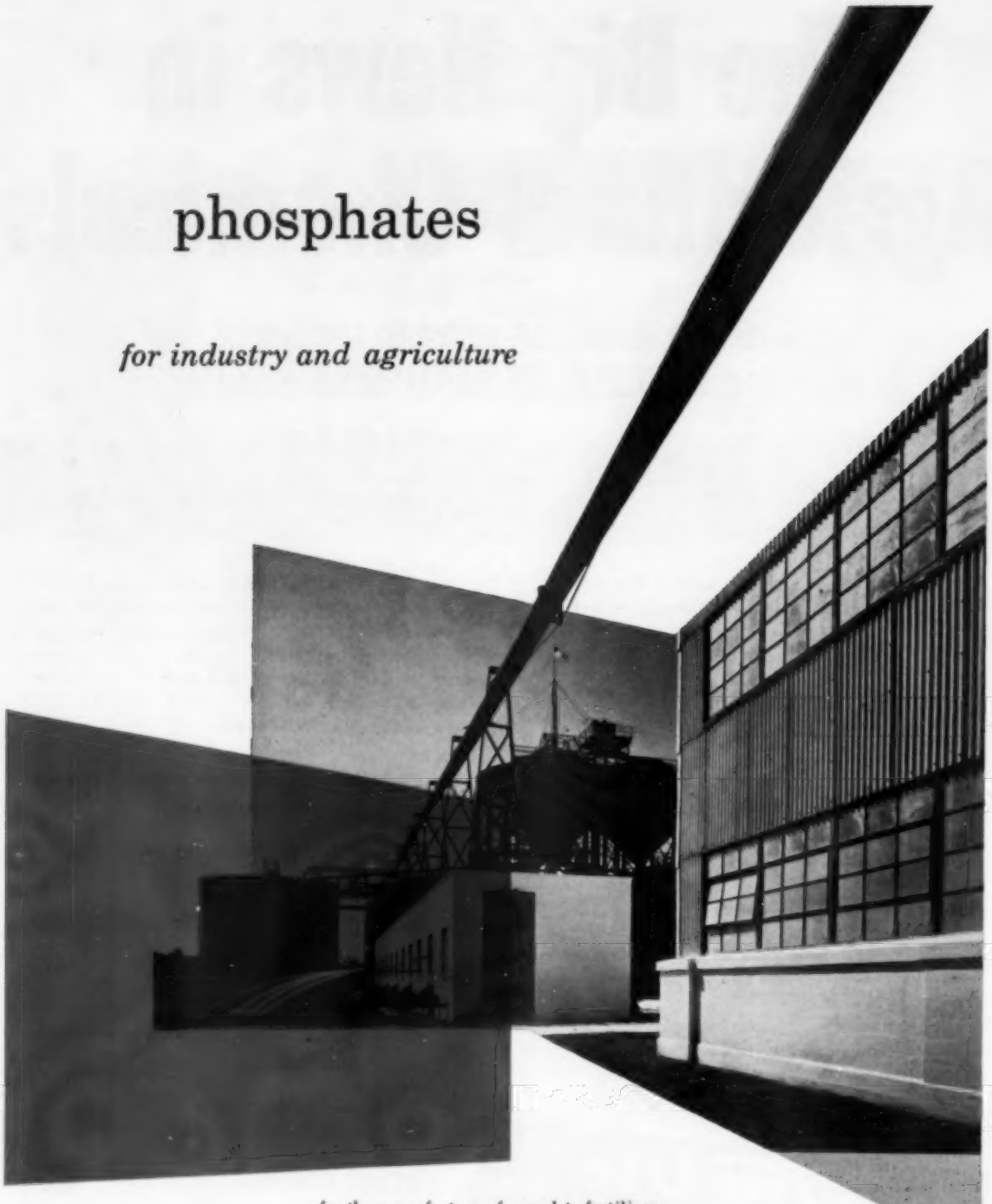
Name.....

Address.....

City.....**Zone**....**State**.....

phosphates

for industry and agriculture



for the manufacture of complete fertilizers.

for the manufacture of industrial chemicals.

ground rock phosphate for direct application to the soil.

International MINERALS CHEMICALS

phosphate minerals division

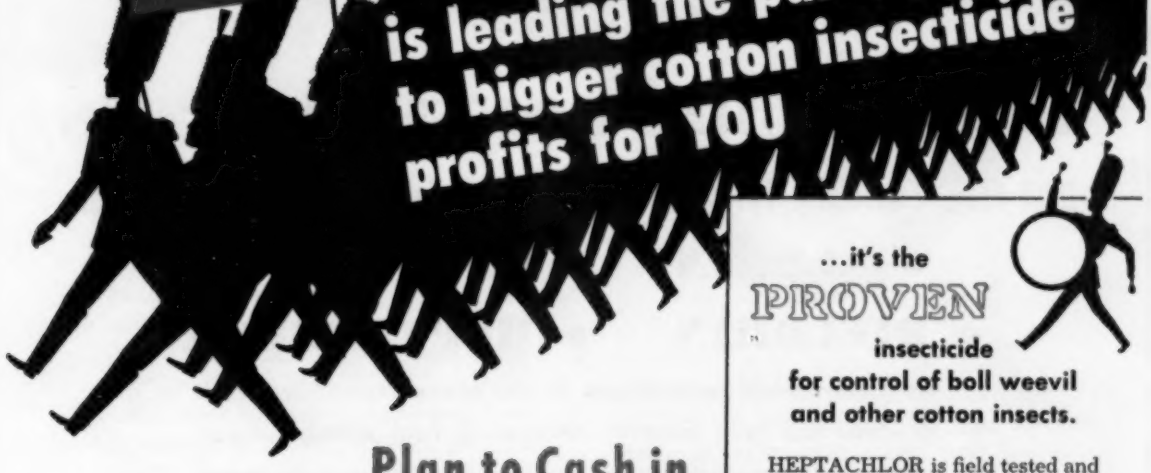
INTERNATIONAL MINERALS & CHEMICAL CORPORATION

GENERAL OFFICES: 20 NORTH WACKER DRIVE, CHICAGO 6 • Phosphate Mines and Plants in Florida at Noralyn, Peace Valley, Achan, Mulberry; in Tennessee at Mt. Pleasant and Wales • INTERNATIONAL produces phosphate, potash, complete fertilizers and feed phosphates for the American farmer.

Attention Formulators . . .

HEPTACHLOR

is leading the parade to bigger cotton insecticide profits for YOU



Plan to Cash in *NOW* on this big 1955 campaign

Join the parade of profit-wise formulators tying in with HEPTACHLOR's big Cotton Insect Campaign. Timed to hit your major market areas right at peak sales time, this new HEPTACHLOR sales drive combines three major media to reach your customers...write *now* for complete details.

RADIO

Hard-hitting radio announcements to cotton farmers...beamed at the highest listening time of day to do a HEPTACHLOR selling job for you.

MAGAZINES

Colorful, eye-catching ads during cotton season to prove why HEPTACHLOR can cut crop losses due to insects and can increase farmer's profits.

NEWSPAPERS

Smash ads in local newspapers giving the HEPTACHLOR story and giving cotton growers a direct pitch to buy HEPTACHLOR NOW and cut crop losses.

...it's the

PROVEN

insecticide for control of boll weevil and other cotton insects.

HEPTACHLOR is field tested and *proven* effective in the control of those cotton insects which can cost farmers up to 25% of their crop. That's why cotton farmers are enthusiastic in their acclaim for HEPTACHLOR insecticides.

- EFFECTIVE—Gives quick and lasting control.
- ECONOMICAL—Only 4 oz. of actual Heptachlor per acre required.
- EASY TO USE—Can be applied with any standard equipment.
- SAFE TO USE—Safe when applied as directed.

CLIP THIS COUPON FOR FULL DETAILS

VELSICOL CORP. DEPT. AC-55
330 E. Grand Avenue
Chicago 11, Illinois

Please send me the information and materials to tie in with the HEPTACHLOR cotton insect campaign.

Name_____
Address_____
City_____ State_____

VELSICOL CORPORATION

General Offices and Laboratories: 330 E. Grand Avenue, Chicago 11, Illinois

REPRESENTATIVES IN PRINCIPAL CITIES

You'll enjoy greater customer satisfaction, more repeat business, greater profits when you use QUALITY CONTROLLED formulations of

MACKWIN
Agricultural
CHEMICALS

INSECTICIDE CONCENTRATES

Dust-Free, Especially Formulated for Commercial Fertilizer Manufacturers

- **ALDRIN**
- **CHLORDANE**
- **DIELDRIN**
- **HEPTACHLOR**

We have several formulations of the above insecticides, each of which has been carefully researched, field tested, successfully used and endorsed by commercial fertilizer manufacturers.

Picture shows Mackwin Insecticide-Fertilizer Specialist E. M. Billings and Mackwin Plant Superintendent Robert Larsen making preliminary set-up prior to transporting and installation in a fertilizer plant . . . another Mackwin service available to fertilizer manufacturers.

Largest Manufacturers of Insecticide Formulations to the Fertilizer Trade

MACKWIN COMPANY

Manufacturing Chemists Since 1889

WINONA, MINNESOTA **Phone 2864**

NOW, DIRECT FROM US, PESTMASTER*DDT Technical for your dusts, wettable powders, solutions, and emulsions. This leading brand of 100% DDT is hard, clean, stable. Its use will add kill, stability and uniformity to your formulations. Phone, write or fill in the coupon below for prices, conditions and samples.

Users or exporters of 75% DDT Wettable powder should investigate our PESTMASTER* Brand. Review its resistance to tropical conditions, its uniform wettable and suspension properties, its carefully controlled packaging which preserves its qualities. Remember, PESTMASTER* 75% DDT Wettable does the job when it gets on the job — Asia, Africa, South America, Europe, here at home—wherever you want it. Write for prices, conditions, samples. Use the coupon.

Send a sample of PESTMASTER* DDT
Technical Grade (100%) ☐ Prices ☐
Send a sample of PESTMASTER* 75%
Wettable ☐ Prices ☐

Name.....

Company or Government Agency.....

City.....State.....Country.....

MC** ©

MICHIGAN CHEMICAL CORPORATION
501 N. Bankson Street, Saint Louis, Michigan

EASTERN SALES OFFICE
230 Park Avenue
New York 17, New York

*REG. U.S. PAT. OFF. **T.M.

D-55-1

QUALITY PRODUCER OF PESTMASTER* DDT & METHYL BROMIDE AND OTHER AGRICULTURAL CHEMICALS

POTASH

The Quality Element

Muriate: 58-60% K_2O

Sulphate: 90-95% K_2SO_4

West German Origin

POTASH IMPORT & CHEMICAL CORPORATION

285 MADISON AVENUE, NEW YORK 17, N. Y.

INDUSTRY News

Calumet Ammonia Plant

Calumet Nitrogen Products Co., Chicago, began construction, early in May, of an anhydrous ammonia plant at Hammond, Ind. The plant is designed to produce 300 tons a day of anhydrous ammonia from refinery by-product hydrogen. Standard Oil will operate the plant for Calumet Nitrogen Products, a new company organized recently by Sinclair Refining Co. and Standard Oil Co. of Indiana.

•

New Chipman Herbicide Plant

Chipman Chemical Co., Bound Brook, N. J., recently purchased a plant at Bessemer, Ala. for future production of herbicides. At present, the plant is being used as a general warehouse and local office.

•

New Ag. Plant in Korea

McGraw-Hydrocarbon, N. Y., a joint venture of F. H. McGraw & Co., and Hydrocarbon Research, Inc., has been awarded a contract for the design and construction of a $5-million chemical fertilizer plant to be built in Korea. The plant will be financed by the FOA and will produce 85,000 tons annually. Estimated time for completion of the project is 30 months.

•

New Fertilizer Firm

Kentucky Farm Chemical and Service Co., has been formed at Louisville, with capital stock of $250,000 to manufacture and deal in fertilizer and other farm chemicals. Organizers are Robert J. Williams, Larrie W. Williams, W. Wilson Branch and James B. Andrews.

•

Stauffer's Mexican Plants

Sauffer de Mexico, S. A., subsidiary of Stauffer Chemical Co., has announced the opening of an administrative office for Eastern Mexico at Edificio La Nacional, Despacho 411, Monterrey, N. L. Mexico. Also announced was the construction of a new insecticide plant at Reynosa, Tamps. Stauffer de Mexico, S. A., manufactures insecticides also at Nogales, Sonora on the West Coast of Mexico. The new plant at Reynosa will replace the present smaller facility at Rio Bravo, Tamps.

•

Squibb Advances Bunney

Dr. William E. Bunney has been named director of manufacturing operations of the E. R. Squibb & Sons Division, Olin Mathieson Chemical Corp. He succeeds Carl E. Anderson, who has resigned to take an executive post in another company.

•

Wilson Heads Armour Aux.

E. W. Wilson was appointed last month to the newly created position of group vice president, supervising all Armour and Co. non-food divisions, including Armour Fertilizer Works. F. B. Patton, general manager of the chemical division, becomes general manager of the Auxiliaries.

Krausche Joins Floridin

Kenneth Krausche formerly with Pennsylvania Salt Manufacturing Co., has recently joined the Floridin Co., Tallahassee, Fla. He is named as research engineer assigned to sales.

•

Ashkraft Sells Valley Chem.

Ashkraft-Wilkinson Co., Atlanta, have completed arrangements for sale of the physical assets of Valley Chemical Co., Greenville, Miss. The new owners will continue to operate the business under the same name.

•

New Canadian Fert. Plant

Construction is expected to get under way shortly on a new 130,000 ton nitrogen fertilizer plant in Medicine Hat, Alberta, Canada, to be operated by North West Nitrogen-Chemicals Co., Ltd. Products will be principally ammonium phosphate and ammonium nitrate, with the first production expected about the fourth quarter of 1956. Financing arrangements for the new plant are expected to be completed in June, and construction will then start. Participating in the new project are Commercial Solvents Corp., New York, and New British Dominion Oil Co., Calgary.

•

Miller Chem. Acquires Site

Miller Chemical & Fertilizer Corp. recently acquired an additional plant at Baltimore, formerly belonging to Bradley & Baker. The site is being renovated and expanded with

addition of 2,000 square feet and installation of equipment for manufacture of dry-mix fertilized.

Operations at the plant are expected to begin during June. In addition to its Baltimore plants, Miller Chem. operates branch plants at Salisbury and Whiteford, Md., and Hanover, Pa.

•

Ketona To Expand

Ketona Chemical Corp., Ketona, Ala., announced last month plans to add facilities for the production of ammoniated nitrate of ammonia at its plant site near Tarrant, Ala. These added installations will be in addition to an ammonia synthesis unit previously announced.

The Ketona plant, jointly owned by Alabama By-Products Corp., Birmingham, Ala., and Hercules Powder Co., Wilmington, Del., will commence production of ammonia this coming fall.

•

Miss. River Chem. Co. Appoints

Appointment of Richard G. Powell as technical service representative was announced recently by Mississippi River Chemical Co., a division of Mississippi River Fuel Corp., St. Louis, Mo.

Mr. Powell will assist Bradley and Baker, distributors of the agricultural products produced by the Mississippi River Chemical Co., in the proper use of the products furnished to fertilizer manufacturers.

Formerly asociated with American Can Co., Mr. Powell has spent the last three and one-half years with Spencer Chemical Co., doing technical service work in the nitrogen field. This involved the handling of ammoniating solutions and fertilizer production problems.

•

Phelps Dodge Execs

Phelps Dodge Refining Corp., New York, announced last month the election of Howard Barkell to the board of directors, and of Charles H. Winship, Jr., to vice-president. Mr. Barkell is a vice-president of the Refining Corp. and Mr. Winship is sales manager of both Phelps Dodge Corp. and Phelps Dodge Refining Corp.

Diamond BL Co. Names Mgr.

Appointment of Wayne D. Wegrich as manager of the Waco, Texas, plant of Diamond Black Leaf Co. was announced recently by George V. Dupont, manager of manufacturing for this producer of agricultural chemicals and pest-control products.

Wegrich comes to the Diamond Black Leaf organization from Minnesota Mining & Manufacturing Co., where he has been a sales engineer for nearly a year.

From 1952 to 1954, he was connected with the Virginia-Carolina Chemical Corp. in various supervisory capacities at its Waco and Richmond (Virginia) plants.

•

Union B. Fertilizer Campaign

A publicity campaign to increase the use of fertilizer by farmers has been announced by Union Bag and Paper Corp., New York. Sydney K. Bradley, vice president in charge of multiwall bag sales, reports that his company is releasing stories each month to 2600 weekly farm newspapers.

Each story in this series hits primarily at soil fertility and succesful farm management through fertilizer usage. This publicity program started in January and will probably continue through the balance of this year.

•

S. C. Fertilizer Meeting

A tour of the Sandhill Experiment Station near Columbia, S. C., will be featured during the annual South Carolina Fertilizer Meeting, Thursday, June 2. The tour will include observation of plant food deficiency symptoms; fertilizer experiments; and yield tests on alfalfa, cotton and peaches.

Brief talks will be given by R. M. Cooper, R. F. Poole; M. D. Farrar, all of Clemson Agricultural College; D. W. Watkins, S. C. Extension Service; R. W. Carter, state veterinarian; O. B. Garrison, director of experiment stations; J. W. Jones, director agricultural teaching; and W. H. Rhodes, Sandhill Experiment Station.

During the afternoon conference members will inspect the Clemson livestock laboratory located at the Sandhill Experiment Station. The relationship of the livestock sanitary department to agriculture will be demonstrated.

•

Beltwide Cotton Prod. Con.

The first annual Beltwide Cotton Production Conference will be held December 15-16 at Hotel Peabody in Memphis. This represents an integrated approach to four major production problems—insect control, defoliation, chemical weed control, and disease control. Previously, the National Cotton Council has sponsored separate conferences on all these problems except disease control.

The new meeting will highlight specific jobs that farm chemicals can do in cotton production, but its scope will be broad enough to cover inter-relationships between chemicals and all other production factors.

Attending will be research and education workers from land grant colleges, USDA, and vocational agriculture, as well as representatives of commercial firms concerned with manufacturing, distributing or applying farm chemicals.

•

U. S. to Sell Pyrethrum Stock

General Services Administration announced plans last month to sell at market value the stock of 60,000 pounds of pyrethrum (20 per cent) extract and 7,818,272 ounces of tataquine now in government storage. Officials explained that the two materials are "obsolescent for use in time of war because of the development of new and better materials."

Sales will begin November 1 and will continue over a twelve month period, according to present proposals. The agency expressed the belief that this plan will eliminate expense of continued government storage and possible loss of the merchandise without harming the pyrethrum or totaquine markets.

•

Stauffer Names Texas Rep.

Stauffer Chemical Co., New York, has announced the appointment of J. L. Keena as a sales representative in the southwest area. Mr. Keena headquarters in the company's Houston, Illinois office.

Pitts Coke Adds Sales Reps

The appointment of Rudy Creasy and Irwin C. Elliott as sales representatives for the Agricultural Chemicals Division, Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., was announced recently.

•

Chester Joins Alton Box

K. Starr Chester recently resigned his post as consultant at Batelle Institute to become technical advisor at the Alton Box Board Co., Alton, Ill.

•

Biological Soc. Meets Sept. 5-9

The 1955 meeting of the Biological Societies, sponsored by the American Institute of Biological Sciences, will be held September 5-9, 1955 at Michigan State College, East Lansing, Mich. Among the societies meeting at this time will be the American Society for Horticultural Science. A more complete program of the meeting will be announced later.

•

Hoover Group Scores TVA

Production of fertilizer by the Tennessee Valley authority was criticized last month by the Hoover commission in a report aimed at getting the government out of areas where it competes with private industry. The commission recommended that the TVA discontinue all chemical research and that its fertilizer research facilities be transferred to the department of agriculture.

It also advised that congress "instruct the comptroller general to determine what the real costs of TVA production are and that thereafter the price of such fertilizer include all costs, direct and indirect, including the loss of taxes which could be obtained from private industry."

(Full details on the Hoover report will appear in the July issue of *Agricultural Chemicals*).

•

Deere Branch to Expand

An expansion project to cost $100,000 was started last month at Horicon, Wis. by John Deere-Van Brunt Mfg. Co., division of John Deere Co., Moline, Ill. The new facility will provide 40,000 additional square feet for storage.

Irving Librett, vice president of Librett Hardwares, Inc., New Rochelle, N. Y., winner of the Brand Names Foundation's annual "Retailer-of-the-Year" contest, receives congratulations from Dr. R. T. Wallace, district manager for the California Spray-Chemical Corp., maker of ORTHO products. The store won the contest from a field of 515 finalists in 25 categories for its excellent merchandising of ORTHO and other nationally branded merchandise. Shown at left is Ulla Vernon, this year's "Miss ORTHO Products."

•

Patent Infringement Claimed

A suit for patent infringement has been filed by American Chemical Paint Co., Ambler, Pa., against Thompson Chemical Corp., Los Angeles, claiming violation of U. S. Patent No. 2,258,292, through sales by the latter of the product "Ana Amide."

•

St. Regis Advances Peterson

St. Regis Paper Company announced last month that Howard C. Peterson, Jr., formerly manager of the eastern district of the multiwall packaging division is now assistant general sales manager of the Kraft Division. John F. Gruber becomes district manager of the Eastern District, which will be expanded to include the present Southeastern District.

•

British Monthly Announced

The first issue of *The Agricultural Review*, a new British monthly magazine designed to provide information and guidance to farmers, was scheduled to be on sale April 27. Editor of the publication is Sir James Scott Watson, recently retired from his posts of scientific adviser to the ministry of agriculture and director of the National Agricultural Advisory Service.

Heads AAC Fertilizer Prod.

The American Agricultural Chemical Co., New York, announced recently the appointment of D. S. Parham as general superintendent, in charge of fertilizer production. Mr. Parham, who has been associated with the A.A.C. Co. since 1947, was formerly general superintendent of maintenance, and has been active in the company's accident prevention program.

•

Limited Amino Triazole

American Cyanamid Co., New York, announced recently the availability, in limited quantities of the new herbicide amino triazole. An "experimental label" has been granted the company, permitting the sale of small quantities to direct users of herbicides, to allow them to test the compound against their particular weed problem. Amino triazole is suggested for use on Canada thistle, quack grass and other weeds.

•

Vulcan Adds to Plant

Vulcan Stamping & Mfg. Co., Bellwood, Ill., have under construction, a new addition to their plant in Bellwood. The structure is 460 feet in length and will be covered with aluminum and fibre glass. Modern equipment and fixtures are planned to improve operating efficiency.

•

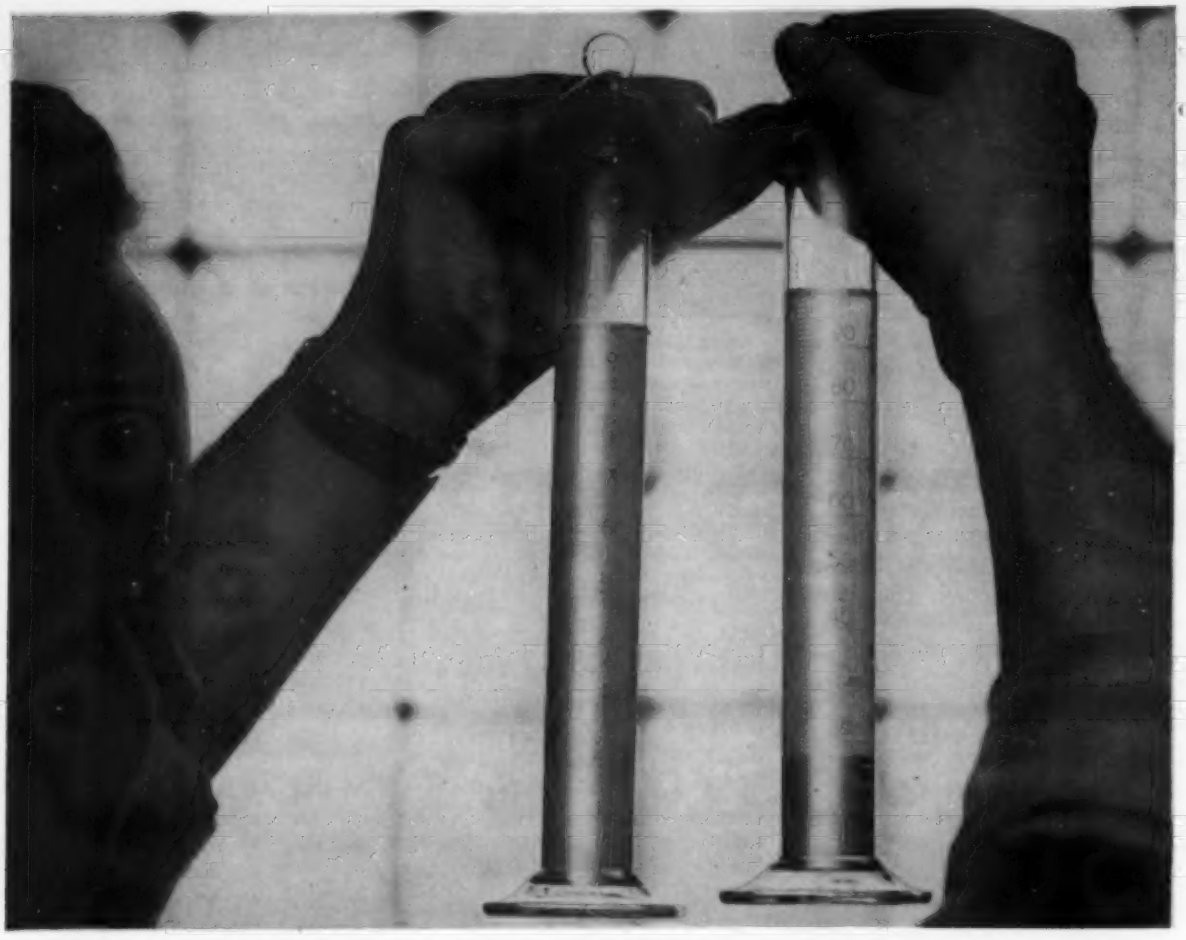
Metalsalts Improves Methods

Advanced refinement techniques have been developed in connection with the production of mercury metals, according to a recent report by Metalsalts Corp. of Hawthorne, N. J. The new mercury is said to present a mirror-like surface brilliance with no observable oxidation apparent.

•

Eagle-Picher Names Engineer

Eagle-Picher Co. recently named Pascal M. Rapier to the post of process engineer at the company's diatomaceous silica plant in Clark, Nev. Mr. Rapier will be responsible for development and processing of diatomaceous earth and filter aids. His last employment was with the Great Lakes Carbon Corp., Walteria, Calif., prior to which he served with Industrial Chemicals, Inc., Pensacola, Fla.



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Purdue Entomologists Assemble Manual

In preparing manuals and proceedings for pest control and agricultural aviation conferences and such short courses as insect and rodent control for sanitarians, Purdue University entomologists use an effective production line schedule to assemble the manuals. Above is a view of the production line putting together a manual, in the entomology laboratory in Agricultural Hall.

At the front table are from left to right, G. E. Gould, B. E. Montgomery, J. J. Davis, and Glen Lehker. Back of Gould is Tom Everly and back of him are Curtis Wilson and H. O. Deay of the entomology department. Back of Davis is an entomology major from Turkey, Meliha Karman. Others in the picture are instructors and students who joined in helping to assemble the material.

Spray Nozzle Tests in Texas

At the Texas Agricultural Experiment Station, College Station, Texas, tests were conducted to determine the best type and arrangement of spray nozzle for applying insecticides to control the cotton bollworm and boll weevil. Higher yields were produced from plots treated with a fan-shaped pattern, according to a brief report in the first issue of a new Texas station publication, "*Texas Agricultural Progress.*" One hollow-cone type spray nozzle, discharging directly over the row resulted in yields equal to those from two or three similar nozzles spraying the top and sides of the drill row.

•

Discuss Chem. Fertilizers

The role of chemical fertilizers in the growth of American agriculture during the last fifteen years was cited last month by Calvin Bullock, New York investment firm, in its publication *Perspective*. The article pointed out how development of synthetic fertilizers made possible agricultural expansion through increased crop yields, rather than by the alternative method of bringing new lands into cultivation.

The combined effectiveness of farm mechanization and the increased use of fertilizers since 1940, it was pointed out, have improved farm output, resulting in a decrease of per capita acreage requirements from 2.0 to 1.86 acres. According to the report, "one farm worker now takes care of eighteen persons as compared with ten persons in 1940."

•

New Heptachlor Labeling Rules

The U.S.D.A. recently announced new label recommendations for heptachlor formulations as emulsifiable concentrates, wettable powders, and dusts. These recommendations cover the use of Heptachlor for controlling armyworms and cutworms. The new expanded recommendations include:

Heptachlor 2E-Emulsifiable (2 pounds of heptachlor per gallon) For control of armyworms on alfalfa and clover: 23.41% heptachlor. This specification applies for control of cutworms on alfalfa, clover and tobacco.

Heptachlor 25% Wettable Powder. For the armyworms on alfala and clover: 25% heptachlor. This specification applies also to control of cutworms on tobacco as well as alfalfa and clover.

Heptachlor 2½% Dust. For the control of cutworms on alfalfa, clover and tobacco. 2.50% Heptachlor. This specification also applies to armyworms on alfalfa and clover.

Pacific ESA Meet June 22

The Pacific Branch of the Entomological Society of America will hold its thirty ninth annual meeting at the Mission Inn, Riverside, California, June 22, 23, and 24.

Branch officers for 1955 include John B. Steinweden, California State Department of Agriculture, chairman; Dr. Walter Carter, Pineapple Research Institute, vice chairman and Dr. Leslie M. Smith, University of California, Davis, secretary-treasurer.

According to program chairman Dr. Martin M. Barnes, University of California, Riverside, the invitational program will include "Statistics in Entomology" by Dr. J. U. McGuire, Agricultural Research Service; "Research and Development Steps to the New Insecticide" by Dr. J. F. Kagy, the Dow Chemical Company; "The Annual Review of Entomology" by Dr. E. A. Steinhaus, University of California, Berkeley, California; "Mite Larvae Parasitic on Insects" by Dr. I. M. Newell, University of California, Riverside; and "Air Carrier Equipment in Citrus Orchards," by Dr. G. E. Carman, University of California, Riverside.

In addition, symposia on the following subjects will be presented: "Insect Population Dynamics" moderated by Dr. R. F. Smith, University of California, Berkeley; Recent Advances in Research with Trypetid Flies," moderated by L. D. Christensen, Agricultural Research Service; "The Khapra Beetle," organized by H. M. Armitage, California State Department of Agriculture; "Aerial Spray Application of Insecticides," moderated by Dr. Kenneth Messenger, Agricultural Research Service; and "The Yellow Clover Aphid," organized by Dr. L. D. Anderson, University of California, Riverside.

•

Brea Names Export Sales Mgr.

Rudolph Groth-Marnat was appointed last month manager of export sales for Brea Chemicals, Inc., Los Angeles, subsidiary of the Union Oil Co. of Calif. Mr. Groth-Marnat was formerly southern California manager of the import-export division of W. R. Grace & Co.

Chocolate Moths • House Flies • Cluster Flies • Blow Flies • Fruit Flies • Roaches • Ants • Silverfish Crickets • Cheese Skippers • Mites • Spiders Hornets • Mosquitoes • Wasps • Box Elder Bugs Confused Flour Beetles • Red Rust Flour Beetles Granary Weevils • Dark Mottled Grain Beetles • Spider Beetles • Angoumois Grain Moth • Mediterranean Flour Moths • Indian Meal Moths • Grain Mites • Clothes Moths • Olive Wasps • Tobacco Moths House Flies • Roaches Mosquitoes • Sand Flies Horse and Deer Flies • Cucumber Beetles • Ticks • Chiggers Fleas • Lice • Bed Bugs Carpet Beetles • Spiders Stable Flies • Mosquitoes Horn Flies Eye Gnats Little Black Ants (and many others)

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CSC Names Watts to New Post

C. J. Watts, Jr., has joined the agricultural chemicals sales department of Commercial Solvents Corp., New York. Mr. Watts will handle the sale and distribution of CSC ammonium nitrate to the fertilizer trade in the southeastern states.

A graduate of Tennessee Wesleyan College, Mr. Watts was formerly with the Davison Chemical Co.

•

Stringfellow Joins Spencer

Mark B. Stringfellow has been named manager of market development at Spencer Chemical Co., Kansas City, Mo. He was formerly with Nopco Chemical Company, Harison, N. J., and prior to that with Carbide and Carbon Chemical Co.

•

Economics of Fertilizer Use

A symposium on fertilizer economic research will be held in Knoxville, Tenn., June 14-16, sponsored by the Tennessee Valley Authority. Participating in the symposium will be representatives of various universities and the U. S. Department of Agriculture. Dr. Earl O. Heady, Iowa State College, will report on "Methodological Problems in the Study of the Economics of Fertilizer Use;" Glenn L. Johnson, Michigan State College, will review "Designing Experiments to Study the Economics of Fertilization;" W. T. Brown, Iowa State College, will report on "Practical Uses of Refined Fertilizer Response Estimates;" Roger C. Woodworth, University of Georgia, will give data on "Organizing Fertilizer Input-Output Data in Farm Planning;" while Lawrence Parks, University of Tennessee, will discuss "Problems in Research with Fertilizer and Moisture Variables."

Other participants in the symposium will include Richard L. Anderson, Clifford Hildreth, and David O. Mason, all of the North Carolina State College; Earl R. Swanson, University of Illinois; Earl W. Kehrberg, Purdue University; John T. Pesek, Iowa State College; Frank F. Bell, University of Tennesse; and Donald B. Ibach, of the U. S. D. A.

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N. F. C. C. Changes Name

The National Farm Chemurgic Council officially changed its name last month to the Council for Agricultural and Chemurgic Research, in conjunction with expansion of activities into all phases of chemurgy.

According to Henry T. McKnight, president, the purpose of the new organization will be "to encourage research in the production, marketing and utilization of agricultural products and to promote profitable application of such research findings through the active cooperation of agriculture, industry, government, and other institutions to these ends." Mr. McKnight explained that the organization will continue to promote and stimulate research, as previously, without engaging in actual research itself.

Formal steps for establishment, including the filing of a charter and by-laws with the Secretary of the State of Illinois, were taken by the council's new executive committee at the council's first meeting in Washington, last month. Included on the executive committee are Edmond M. Cook, John Deere & Co.; W. Rhea Blake, National Cotton Council; Howard L. Roach, Plainfield, Iowa, farmer; Dr. K. Starr Chester, and Mr. McKnight.

Council officers elected at the meeting were: Chairman of the board, Wheeler McMillen, editor-in-chief of *Farm Journal;* Mr. McKnight, pres.; Dr. Chester and Mr. Roach, vice president; Robert D. McMillen, secretary; John W. Ticknor, treasurer; Lloyd Partain, of *Better Farming,* assistant secretary, and D. Howard Doane, Doane Agricultural Service, St. Louis, honorary vice-president.

•

Names Ryan, Moenkhaus

Fulton Bag and Cotton Mills, New Orleans, announced recently that John Fulton Ryan had been appointed manager of their St. Louis multiwall paper bag division. They also announced that August W. Moenkhaus has been named manager of textile and multiwall bag sales in the St. Louis territory. Mr. Ryan has been with Fulton for 25 years, while Mr. Moenkhaus joined Fulton some 28 years ago.

Ayers Bemis-Vancouver S. Mgr.

F. W. Ayers has been made sales manager of the Vancouver, Washington, multiwall bag plant of Bemis Bro. Bag Company. He was formerly sales manager for the multiwall department of the company's San Francisco plant.

Mr. Ayers joined Bemis in 1931 at the Peoria paper mill and bag factory, and in 1937 took up promotional work for newly developed types of paper bags. He became a factory representative in 1939 and transferred in 1946 to multiwall sales work at San Francisco, where he was made multiwall department sales manager one year later.

•

NSC Insurance Committee

The fertilizer safety section of the National Safety Council recently established an insurance advisory committee, with the function of providing members with detailed specific information on rate structures and accident prevention as it pertains to insurance rates.

The committee will be under chairman George L. Pelton, personnel director of the the Smith Agricultural Chemical Co., Columbus, O.

•

Picco Appoints Roberts

Pennsylvania Industrial Chemical Corp., Clairton, Pa., has announced the appointment of William J. Roberts as director of research, succeeding A. L. Ward, who retired recently. Nicholas C. Gangeni will fill Dr. Roberts' former post as assistant director of research. Dr. Roberts has been with Picco since 1945, serving as assistant director of research for the past eight years.

•

Pitts. Assumes Ethyl Program

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., announced last month that it has completed arrangements whereby it has acquired the agricultural chemicals program recently terminated by Ethyl Corp. Under the agreement, Pittsburgh Coke & Chemical will continue the further evaluation, development and marketing of products that have been investigated in Ethyl's research program with promising results. One of the compounds in this program is the new fungicide B-622.

Extra Care Means Better Bags for You

Experienced inspectors carefully examine newly tubed bags before they move on to sewing machines. Careful inspections after every step in the production of V-C Multiwall Bags mean a better package for your product.

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V-C Multiwall Bags are made by people who understand the importance of careful construction. It's this extra care in construction that makes V-C multiwalls better for your product. Extra care plus modern bag-making methods, materials and machinery give V-C multiwalls the ability to stand rough treatment while your product is being shipped or stored. Without cost or obligation, ask for full details about better-built V-C Multiwall Bags.

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Form Canadian Firm

Agricultural Institute of Canada, was recently formed at Ottawa, Canada, with Wallace A. Thomson, Pense, Sask., as president. Directors are H. F. Stairs, Fredericton; H. A. Steppler, Montreal; L. M. Ramsay, London; and Dr. Sol Sinclair, Winnipeg.

•

Shea Moves To Indiana

Executive offices of the Shea Chemical Corp., which have been located in Baltimore since mid-1952, moved last month to Jeffersonville, Indiana, where the corporation recently built permanent office quarters.

In addition to producing phosphorus, the Shea Corp., produces calcium phosphates for the feed industry, phosphoric acids for industrial uses and fertilizer manufacturing, and sodium phosphates primarily for the detergent and cleanser industries.

•

Miller Proposes New Bill

A congressional bill that would protect the public from harmful food additives without involving the food industry in unnecessary red tape was proposed in the House of Representatives by Rep. A. L. Miller, author of the legislation on pesticides tolerances. Mr. Miller's proposal differs from those previously offered in that it does not require licensing of food additives and would limit the powers of the Secretary of Health, Education and Welfare in the disposition of new materials developed for food uses.

The proposed legislation would guard the interests of the general public by requiring that prior notification of new food additives be filed with the Secretary of Health, Education and Welfare 120 days before the proposed date of marketing. If the secretary renders a favorable opinion or fails to act within the allotted time, the applicant may proceed to market the additive.

The bill applies to all "new food additives." By definition, however, substances generally recognized among experts as being without hazard to the public health in their present uses are excluded from its operation. Pesticide chemicals are specifically excluded, and new packaging materials are treated separately.

•

Schroeder Buys Omaha Firm

Omaha Retinning Corp., Omaha, Neb., has been purchased by C. L. Schroeder, president. Other officers are Mrs. G. M. Schroeder, vice president; Melvin Arnold, secretary; Mrs. Rose Jackson, assistant sec'y.

Mr. Schroeder, until recently, was national sales manager of Omar, Inc., a baking and food firm, and previously vice president and general sales manager of McLaughlin Gormley King Company, Minneapolis.

•

Aviation Conf. Proceedings

Proceedings of the fourth annual Indiana-Ohio Agricultural Aviation Conference, which was held in February 1955, have been compiled and are now available at $3.00 through J. J. Davis, Purdue University, Lafayette, Ind.

•

German Co. Offers Emulsifiers

Dehydag, Deutsche Hydrierwerke in West Germany, manufacturer of fatty alcohols and their derivatives are now supplying new emulsifiers for pesticides through the USA distributors—Fallek Products Company, Inc., New York.

"Dehydol" is a new non-ionic surface active agent based on fatty alcohol ethylene oxide, compatible with anion and cation active substances, stable in acid and alkaline media up to a pH of 14. It is used as a wetting agent in the manufacture of water dispersible insecticides.

"Emulgin M8" is a non-ionic emulsifier manufactured on a basis of fatty alcohols. It is an amber colored paste which remains constant at temperatures varying from -5°C (23°F) to 40°C (104°F). An emulsifier for the preparation of fine and stable emulsions resistant to electrolytes, Emulgin M8 is suggested for the preparation of pest control products.

Amer. Potash Sales Up

Sales and earnings of American Potash & Chemical Corp. for the first quarter of 1955 exceeded the volume of $5,992,645 and net of $1.01 a share reported for the same period of last year. Volume for 1954 was announced as $23,631,032 as against $22,461,056 for 1954, and earnings as $2,510,909 equal to $4.38 a share compared to $2,116,082, equal $4.01 on fewer shares outstanding in 1953.

•

Eastern Opens Midwest Office

Eastern States Chemical Corp. recently opened a Chicago terminal for marketing in the mid-west. In addition to the terminal facilities, division offices have been opened at 1011 Lake St., Oak Park, Ill. Ed Von Doersten is division manager in charge of the Chicago operation.

•

Ray-O-Vac Buys Willson

Willson Products, Inc., manufacturer of industrial safety equipment, was recently purchased by Ray-O-Vac Co., Madison, Wisconsin. The Reading, Pa., firm, founded in 1870, is today one of the leading manufacturers of industrial protective devices.

Mr. J. Clyde Ryan, executive vice president of the Ray-O-Vac Co., was elected president and general manager of Willson Products, Inc., following the annual stockholders' meeting on April 12.

Mr. Ryan succeeds Mr. Thomas A. Willson, who was elected chairman of the board of directors. Dr. Frederick Willson, who has been chairman of the board since 1942, has retired. Thomas A. Willson, Jr., was elected vice president in charge of production.

•

Griffin Retires USDA Post

Dr. E. L. Griffin retired last month as assistant head of the pesticide regulations section of the plant pest control branch of the Agricultural Research Service of the Department of Agriculture, after forty-two years of service. The occasion of his retirement was honored April 27 by the National Agricultural Chemicals Association and other representatives of the pesticide industry.

Carolinas-Virginia Pesticide Formulators Assn. Holds First Meeting at Raleigh

William Pickett, Farmers Cooperative Exchange, Statesville, N. C. board member; J. M. Maxwell, Maxwell Insecticide Co., Raleigh, 2nd v-pres.; W. P. Crown, Carolina Chemicals, Inc., W. Columbia, S. C. 1st v-pres.; W. R. Peele, W. R. Peele Co., Raleigh, N. C., president; G. Simches, Planters Chemical Corp., Norfolk, Va.; R. A. Tiller, Southern Agric. Chemicals, Inc., Kingstree, S. C., board member; John Daly, Daily Herring Co., Kingston, N. C., board member.

THE first spring meeting of the newly organized Carolinas-Virginia Pesticide Formulators Association was held at Scandia Village, Raleigh, N. C., May 3 and 4, with approximately seventy active and associate members in attendance. The two-day program got under way the afternoon of May 3rd with a conducted tour through the laboratories, greenhouses and other facilities of North Carolina State College and a visit to the N. C. State analytical laboratories. A cocktail party, social hour and banquet constituted the evening's program.

Following a short business meeting on the morning of May 4th, three talks completed the program. Dr. E. W. Constable, N. C. State Chemist, spoke on "The Functions of the North Carolina State Analytical Laboratories," outlining the job performed by the laboratory which he supervises in enforcing state regulations dealing with testing and sale of insecticides, fertilizers, fungicides, herbicides, etc.

Dr. Clyde Smth of State College discussed "The Future of Our Industry," pointing out that insecticides are a major factor in North Carolina's agricultural economy. He estimated that insects still cost farmers of the state 100 million dollars a year, in spite of the effective control measures in general use. He predicted a bright future for the insecticide industry, and the general profession of entomology, anticipating a one hundred per cent expansion in the insecticide business in North Carolina in the next ten years. Yet some, he indicated, now in the industry, may no longer be in business, giving a general idea of the financial hazards involved in making and selling insecticides at a profit.

The insecticide industry, he believes, has just scratched the surface. With better insect survey information, much more insecticide can be sold and used profitably, the problem being to have it in the hands of the user where and when it turns out to be needed. He pointed out that with the growing population, we must grow more food—which automatically means more widespread and intelligent use of every agricultural chemical aid to crop production. And, he added, "insects are still doing more damage to our forests than fire," thus indicating a tremendous potential for increase in use of pesticides in forest protection.

Turning to a review of pesticides on various crops, Dr. Smith indicated his belief that as much insecticide is currently being used on tobacco as is needed. As for cotton, while he expressed the belief that insecticide is being misused on this crop to a certain extent, many years more insecticide could profitably be used. More accurate and dependable surveys would be a big help here, he believes.

Little increased use of pesticides is needed on peaches and apples, said Dr. Smith, for a good job of protection is already being done on these crops; however a big increase in use may be expected on peanuts, particu-

larly in the direction of increased use of soil insecticides. Increased use would also be profitable on corn, he added. In control of forage crop pests, he feels that we have not yet even scratched the surface. We don't yet know what insects are causing reduction in yields, or what the amount of the damage is.

An increase may be anticipated in vegetable production in the State of North Carolina, Dr. Smith believes, because farmers in the state are now getting better insect control; and as better control is achieved more people will be encouraged to go into vegetable raising.

The speaker estimated that between eight and ten million dollars per year are currently being spent on pesticides in the state. This could readily be doubled, he feels. Only fifty per cent of the potential on cotton is currently being employed. There is an excellent prospect for increased use of pesticides for forest and forage crop protection, and if a good method of control can be worked out for protecting stored products on the farm he sees a big increase in the potential market in this direction. An expanding market is also seen for small package materials for control of pests on ornamentals. Perhaps the brightest prospects are seen in a greatly expanded sale of pesticides for control of soil insects.

Accompanying this expanding pesticide market over the next ten years, and aiding in further expanding the market, Dr. Clyde Smith predicts increased use of scouts to tell the grower when and where to apply his materials, greater treatment of acreage by the custom sprayer on contract, improved application equipment, and better timing of spray and dust applications.

The final speaker on the program was G. Wesley Williams, executive secretary of the Raleigh Merchants Association, who discussed "Business Management," with particular reference to the role of the successful trade association in aiding its industry to operate, efficiently and profitably.

The annual meeting of the group will be held in October, time and place to be announced later.★★

As AC's Camera Man Saw The Meeting

(1) Tom Lytle and Gene Lemire, Shell Chemical Corp., New York; Al Fuchs, Diamond Alkali Co., Cleveland; and George Simches, Planters Chemical Corp.

(2) Dr. E. W. Constable, N. C. state chemist in charge pesticide control work; Dr. Clyde F. Smith, in charge entomology dept. North Carolina State College; and Dr. John Ellis, in charge plant pathology dept. N. C. State College.

(3) Fred Chappell, R. T. Vanderbilt Co., New York; R. W. Stephenson, Kirby Chemical Co., Severn, N. C.; Hugh Horne, Howerton Gowen Co., Roanoke Rapids, N. C.; William Gehweiler, R. T. Vanderbilt, New York.

(4) D. A. Robishaw, Planters Chemical Corp., Norfolk; J. N. Thompson, Graham Chemical Co., Greensboro, N. C.; William Feustel, R. T. Vanderbilt, New York; Ted Reideburg, Theodore Riedeburg Associates, New York; E. R. Hatton, Planters Chemical Corp., Norfolk.

(5) James Lawler, Shell Chemical Corp., New York; Kenneth Holden, Chemagro Corp., New York; Jack Moore, Floridin Co., Tallahassee, Fla.; and Dr. Clyde Smith, head of entomology department, North Carolina State College, Raleigh, N. C.

(6) T. W. Brasfield, U. S. Rubber Co., Naugatuck Div., Naugatuck, Conn.; George Silvera, Larvacide Products, New York; Phil Arey, Naugatuck Div.

(7) A. E. Leavitt, Apex Chemical Co., Apex, N. C.; E. E. Heuermann, Shell Chemical Co., New York; Homer Ketchie, Diamond Alkali Co.; and William Crown, Carolina Chemicals.

(8) Robert Gast, N. C. State College; and R. P. Neptun and John F. Myers, S. B. Penick & Co., New York.

(9) Wesley Williams, Exec. Sec., Raleigh Merchants Assoc.; J. E. Boyd and Edward Phillips, Glendon Pyrophyllite, Glendon, N. C.

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Canadian Potash Industry

Potash currently being mined in Saskatchewan by American firms may, in the near future, be a major mineral export, according to an article appearing last month in Toronto's *Financial Post*. The report estimates that—when full potash reserves are known—the province may prove to have as much as 100 billion tons.

Currently, the biggest operation is Potash Co. of America's $3 million shaft sinking project, which, it is estimated, will take about two years. Other major operations are currently underway by Duval Sulphur and Potash, Western Potash, International Minerals and Chemical Corp. and Poplar Oils Ltd.

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Mathieson Appointments

Joseph Mullen, Jr. has been named general manager of the newly created Western Fertilizer Division of Olin Mathieson Chemical Corp., with headquarters in Little Rock. W. W. Lehle has been named manager of the Western Sulphur and Acids Division, also with headquarters at Little Rock.

•

Bemis Reorganizes Sales Div.

Bemis Bro. Bag Co., St. Louis, recently announced organizational changes designed to concentrate sales activities and increase sales coverage in Indiana, Ohio, Kentucky and Michigan. Three senior salesmen have been designated sales supervisors. They will report to A. C. Greer, sales manager of the Indianapolis division. The three sales supervisors are:

U. E. Philpott, formerly plant merchandiser at the Indianapolis plant, who will supervise sales in Indiana and Ohio.

R. C. Thomas, formerly sales representative with headquarters in Grand Rapids, who will be in charge of the Detroit sales office and supervise sales in Michigan.

F. H. Schardt, manager of the Louisville sales office, who will have supervisory responsibility for sales in Kentucky.

Also involved in the reorganization are H. F. Wilson, who will move from Detroit to Indianapolis to assist the sales manager on sales promotion activities, and E. G. Harvey, who was assistant sales manager and will become plant merchandizer for the Indianapolis Plant.

Mr. J. A. Davies has transferred from the Louisville office to Grand Rapids for sales work in that area, and Mr. F. L. Ashinger has been moved to Detroit to work out of that office.

•

Engle Named to FOA Job

Robert H. Engle, who has been with the NFA as agronomist and film director for the past sixteen years, recently accepted a position with the Fertilizer Division of the U.S. Technical Cooperative Mission to India. Mr. Engle will be located in New Delhi, working with Dr. Frank Parker, formerly with the USDA in Beltsville. The cooperative mission is under sponsorship of the Foreign Operations Administration.

Calif. Garden Show in Sept.

Dealers from California and other western states will attend the Western States Garden Supply Trade Show at Oakland, Calif. Sept., 13-15. The Chicago show will be held in January, 1956, while the New York exhibit will be in February.

•

NSC Announces Awards

Agricultural Chemicals and 29 other trade magazines were among the recipients of the 1954 public interest award of the National Safety Council. The awards are presented annually for service to safety.

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This is only one of many different packages that Shellmar-Betner now makes for chemical products. If you'd like better flexible packaging for your product, check with Shellmar-Betner.

SIFT-PROOF—
Specially lined and sealed, Duotite bags give double protection against sifting. Customers get full measure of quality.

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More Generous Fertilizer Use Urged to Boost Farm Profits

OKLAHOMA farmers were urged to make more generous and more effective use of fertilizers and thus to achieve lower cost production in an address given by Dr. W. H. Garman, agronomist, American Plant Food Council, Inc. before the Oklahoma City Farm Club on April 28. The title of Dr. Garman's address was "More Farm Profits without Added Surpluses." He reminded his listeners that "The efficient farmer today must make use of all good practices at his disposal, which include up-to-date methods of disease, insect and weed control, and he should also follow his experiment station's recommendations with reference to use of fertilizer."

He noted with some concern that farmers in most areas of the country are still falling down rather badly so far as complying with state recommendations on fertilizer usage: "In most states, the average farmer is using less than one-half the amount of fertilizer that is recommended by his experiment station. This, in spite of the fact that 1954 was the sixteenth consecutive year of increased consumption of plant foods in the United States."

He observed that a good many farmers today use recommended insect control practices, plant disease-resistant varieties, and do a good job of controlling weeds, but yet they do not fertilize as they should. This means that they cannot possibly realize full value from the money spent for these other chemical aids to agricultural production.

Documenting his thesis that the proper use of fertilizer is the most important "tool" responsible for increased farm efficiency, Dr. Garman cited a number of examples to prove that by more generous use of fertilizers, farmers can make more money by farming less land. In 1950, he stated, Oklahoma farmers harvested 1.239 million acres of corn, the average application of nitrogen, phosphoric oxide, and potash per acre being 3, 4, and 2 pounds respectively for the three nutrients. The average yield of corn was 25 bushels to the acre. According to experiments conducted at Oklahoma A. & M., the average per acre yield of corn could have been 51 bushels if 40 pounds of nitrogen to the acre had been applied together with 20 pounds of phosphoric oxide and 20 pounds of potash. The approximate cost for the total treatment would have been about $8.50 per acre.

By using the more substantial quantity of fertilizer, Oklahoma farmers could have realized the same number of bushels of corn from 620,000 acres of land that they actually harvested from 1.239 million acres; and the same number of bushels would have brought exactly the same number of dollars. He indicated a net saving of 13.3 million dollars possible in the Oklahoma area by the reduced cost of growing the same crop on about half the land area.

And he noted further that under most conditions in areas of Oklahoma adapted to corn, even 40 pounds of nitrogen would not be the most efficient quantity to use. It would be nearer to 80 pounds per acre. Yields and savings could have been even higher than those noted, had experiment station recommendations for rate of fertilizer use been followed.

Taking another example from the wheat crop, he noted that during the ten year period 1941 through 1950, an average of 5.365 million acres of wheat were harvested in Oklahoma annually, with total production averaging 71,737 million bushels, or 13.4 bushels per acre. With 40 pounds of nitrogen and adequate supplies of other plant nutrients, the yield could have been raised to 32 bushels to the acre.

Figuring fertilizer cost again at $8.50 per acre, the cost of raising wheat on the more heavily fertilized acreage would have been about $20.50 per acre, rather than the actual average cost of $12.00 per acre. By using the added $8.50 worth of fertilizer per acre, the same number of bushels of wheat could have been grown on 2.4 million acres as were actually produced on 5.365 million acres. Production costs, he estimated, would have been 18.5 million dollars less than the average amount of money spent in each of the previous ten years by Oklahoma wheat growers,—and for the same output.

Concluding his address with a look to the future, Dr. Garman predicted that: "When research makes possible the control of insects, parasites, diseases and weeds, we will realize the productive capacity for about 120 million additional acres. Beyond this, if we were to use cropping systems and fertilization practices that would prevent soil deterioration and fertility decline, we could perhaps produce our present food and fiber needs on one-half of the land we now use for crops and pasture."★★

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"Uramite" Fertilizer Developed

A new fertilizer material which reportedly will release nitrogen continuously and uniformly throughout the growing season has been developed to a commercial stage by the polychemicals department of E. I. du Pont de Nemours & Co., Wilmington, Del.

Trademarked "Uramite" fertilizer compound, the new material combines a high (38 per cent) nitrogen content with a prolonged release-rate. New plant facilities at Belle, West Va., will be in full production of the material by mid-summer, the company announced.

Chemically, "Uramite" is a mixture of methylene ureas, materials which are almost completely water-insoluble. In the soil, however, "Uramite" is dissolved slowly over a period of months at a rate conformable with moisture and temperature, and its nitrogen is gradually converted to a form which is available to plants. As this slower release rate is of particular importance to professional growers of turf and ornamental plants, it is planned that initial supplies of "Uramite" will be marketed to these groups.

Panels on Field, Vegetable Crops At California Fertilizer Conference

APPROXIMATELY 300 persons from various portions of the United States took part on April 26th in the program of the third annual California Fertilizer Conference, sponsored by the Soil Improvement Committee of the California Fertilizer Association, and held on the campus of the University of California, College of Agriculture at Davis, California. A rotating group of three panels permitted open discussion of each subject by the entire attendance. Panel discussions were held on field and forage crops, with John Tollefson, Salinas, as moderator; vegetable crops, Weir Fetters, Stockton, as moderator; and deciduous and citrus fruit crops, moderated by Robert E. Whiting of Hayward.

Dr. H. J. Gramlich, former head of the department of animal husbandry, University of Nebraska, and more recently director of agricultural development for the Chicago and Northwestern Railway System, spoke at the annual banquet. He said that there have been more changes in agricultural practices throughout the world in the last 50 years than in the 2000 preceding years, furthermore that most of changes occurred in the last ten years. During this period, use of plant food has increased 3½ times, he said, as the result of new knowledge gained as to the value of commercial fertilizer, and new technology in its production.

CFA president B. H. Jones of Sunland Industries, Inc., Fresno, presented the welcoming address and thanked the officials of the University of California for the use of its facilities and for their active assistance in arrangements and in participation in the program for the conference.

M. E. McCollam, American Potash Institute, Inc., San Jose, and chairman of the Soil Improvement Committee, CFA, reported that thorough sampling and testing of at least 130 California soil types has shown about 30% of these types to be low to very low in potassium level by the Neubauer standards. These low potassium readings occurred most frequently on the sandy and sandy loam soils of the east side of the San Joaquin Valley, in the coastal areas, the coastal valleys of central California, in southern California, and in the northern Sacramento Valley. During this research, interest increased in the chemical analysis of plant leaves as a more accurate guide to plant nutritional requirements.

Stanley Freeborn, University of California, Davis, outlined the program of the University and other land-grant colleges which train students in agriculture and other subjects. He pointed out that during a period when the country's population has been increasing by several hund-

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red per cent, the enrollment of basic agriculture students has increased by only two or three per cent. He emphasized the need to interest students in professions in the field of agriculture.

LeVerne N. Freimann, county extension agent, Whatcom County, Bellingham, Washington, outlined the results obtained at the Benedict Demonstration Farm which has been operated as a project during recent years in his county. This 100 acre dairy farm had been cropped until its productive capacity had about been exhausted. For this reason, it was chosen by a group representatives of Washington State College, Farmers' Home Administration, Soil Conservation service, banks, farm equipment dealers and the fertilizer industry as the ideal one on which to stage a fertilizer demonstration. As the result of proper fertilization and other approved farming practices this unproductive land, which had been unable to sustain 14 milk cows and 18 head of young stock was, within three years, supporting more than 3 cows per acre on the ladino and orchard grass pasture, and the herd had been increased to 32 milk cows. Sufficient surplus feed is now produced during the growing season to allow storage for winter feeding. Freimann pronounced the experiment an outstanding success.

A. George Park, Balfour, Guthrie & Co., Limited, San Francisco, reported on the results to date of 13 large scale rangeland demonstrations in nine California counties sponsored by his firm.

Robert Z. Rollins, California State Bureau of Chemistry, Sacramento, outlined some of the newest problems which attend the growing use throughout the country of pesticide-fertilizer mixtures. In California, he said, such mixtures must be registered under both the fertilizer control laws and those pertaining to the control of pesticides. In addition, they must conform to the schedule of tolerances recently placed in effect by the Federal Food and Drug Administration. It is also important that the pesticide material involved be chemically compatible with the fertilizer ingredients. He said that in California, farmer demand for pesticide-fertilizer mixtures has not grown as rapidly as elsewhere.

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USDA Appoints Mehring

The USDA announced recently the appointment of Arnon L. Mehring to head the fertilizer work of the Commodity Stabilization Service. Mr. Mehring will study the supply-demand conditions for fertilizer, and will edit the *Fertilizer Situation*.

Hercules Appoints Crabtree

The appointment of Robert W. Crabtree as manager, nitrogen products sales, was announced recently by Hercules Powder Co., Wilmington. Mr. Crabtree will supervise the sales of nitrogen products produced at the company's Louisiana, Missouri, and Hercules, California, plants.

Mr. Crabtree, who has been with Hercules since 1934, has been sales manager for nitrogen products in San Francisco.

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Discuss Handling Pesticide-Fertilizer Mixtures

A DISCUSSION of "Health Aspects of Handling Pesticide-Fertilizer Mixes," by James P. Hughes, M. D., Ohio State University, was featured at a joint session on chemical and fertilizer plant safety at the Governor's Health Conference and Exhibit, held May 5, 6, Baltimore. Other sessions pertinent to the agricultural chemicals industry were the fertilizer plant safety session, Thursday afternoon, May 5, and the chemical plant session on May 6. Chairman of all three meetings was Wendell Lockwood, Davison Chemical Co., Baltimore.

Dr. Hughes' talk, which was delivered Friday afternoon, emphasized health problems encountered by the small fertilizer formulating company as a result of incorporating insecticides in its product. He mentioned that fertilizer firms have been hesitant to adopt the mixed product because of the more complicated legal situation involved, increased marketing difficulties, and the need for special equipment and operating methods. But, according to Dr. Hughes, the health aspect is the most urgent consideration involved in the change-over.

He pointed out that, since fertilizer chemicals are not dangerously toxic, plants devoted exclusively to fertilizers must add new medical facilities and establish detailed safety precautions when adding insecticides to their products.

The speaker stressed that any safety program should be tailor-made to fit the operations carried on at the individual plant. He advised that the company physician and his staff should have an adequate knowledge of the type of work going on at the plant in all its phases. This and a periodic physical check-up, he suggested, constitute the best protection against any of the cumulative ill-effects that can result from regular contact with the new pesticide chemicals.

The acute reaction to toxic chemicals, resulting from a single massive exposure, can occur only where there is flagrant neglect, or ignorance, according to Dr. Hughes. Such severe cases can be avoided through precautions based on the information and suggestions which most insecticide manufacturers supply to formulators. Further assistance in this respect is available from health and industrial hygiene groups.

The session concluded with questions addressed to the speaker by members of the audience.

The Thursday afternoon session on fertilizer plant safety included an address by Thomas J. Clarke, G. L. F. Soil Building Service, Ithaca, N.Y., and a panel discussion of four case histories of unusual accidents in the fertilizer industry. Panel members were Edward Derr, Olin-Mathieson Chemical Corp.; H. C. Calvert, Davison Chemical Co.; C. M. Barker, Virginia-Carolina Chemical Corp.; and R. D. Dent, Baugh Chemical Corp., all of Baltimore. George F. Dietz, safety engineer, Fertilizer Manufacturing Cooperative, was moderator. Mr. Clarke's talk, entitled "I Believe," reviewed the history and objectives of the fertilizer section of the N.S.C. and some of its projected goals for the future.

Joseph Guelich, Allied Chemical & Dye Corp., N. Y., opened the chemical safety session, with an outline of safety procedures for entering and cleaning tanks and tank cars. The procedures recommended by Mr. Guelich were (1) careful supervision and limitation of tank entry permits, (2) regular testing and preparation (3) maintenance of uniform conditions within the tank, and (4) establishment of emergency procedures to minimize effects of accidents.

Following Mr. Guelich's talk was a demonstration of industrial and military gas masks. Brigadier General Marshal Stubbs, Commanding General, Chemical Corps Material Command, spoke on "Gas Masks in Peace and War." He was introduced by John M. Roche of the Chemical Corps Material Command.

Great Plains AAA Meet

Great Plains Agricultural Ammonia Association Midwest Trade Show and Field Day is scheduled for July 20-21. Business session and show July 20 at Hotel Ft. Des Moines, Des Moines, Ia. Field Day, which is being held in cooperation with Iowa State College, will be held at Ames, Iowa, July 21. Field Day is open to the public. Details and reservations may be secured by writing to James Andrew, Secretary, Great Plains Agricultural Ammonia Association, Box 447, Jefferson, Iowa.

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Verdery Joins Mathieson

A. B. Verdery has been appointed eastern district sales manager of Olin Mathieson Chemical Corp.'s eastern fertilizer division. His headquarters will be in Baltimore. Mr. Verdery was formerly president of his own company, the August Fertilizer Co., Augusta, Ga. He is a graduate of Clemson Agricultural College, Clemson, S. C.

Joint Fert. Meeting Planned

The National Joint Committee on Fertilizer application and the American Society of Agronomy have scheduled a cooperative program to be held Aug. 15 at the University of California, Davis, Cal. The program will feature six detailed reports on soil fertility, fertilizer application, irrigation, as well as recent developments in farm placement machinery.

Presiding will be D. G. Aldrich, Jr., vice chairman of the National Joint Committee on Fertilizer Application. Among the reports listed in the advance program are "A Comparison of the Fertilizer Value of Gaseous, Liquid and Solid Forms of Ammonium - Containing Nitrogen Compounds," O. A. Lorenz, University of Calif., Davis; "Application of Fertilizers Through Sprinklers," D. W. Henderson, University of Calif., Davis; and "Fertilizer Application and Improved Crop Yields in the West," B. A. Drantz, U. S. D. A., Billings, Mont.

Indiana-Ohio Agri. Aviation Conf.

TOPICS discussed at the fourth annual Indiana-Ohio Agricultural Aviation Conference, held Feb. 23-25 at Purdue University, Lafayette, Ind., included estimations of insect damage in 1954, insect control through airplane application, and the future of the helicopter in agricultural aviation. Also reported were aerial application of liquid fertilizers, granular insecticides, the use and value of the airplane in defoliation and in legume insect control, along with other aspects of agricultural aviation.

H. R. Lathrope, Allied Chemical & Dye Corp., led off the agronomy session with a report on "New Aviation Developments in the Field of Agronomy." Following Mr. Lathrope, Robert G. Ueding discussed plant defoliants, listing four reasons for defoliation of soy beans: 1. To speed up field drying, thus permitting an early harvest. 2. To destroy weeds, 3. To improve crop quality, and 4. To increase yields by allowing the farmer to harvest the beans he has grown. According to Mr. Ueding, an adequate material for defoliation of soy beans under all conditions has not yet been developed. He said that pentachlorophenol is the best product currently available, although it does not function too well in cool, damp years. A really effective material, according to Mr. Ueding, should be able to dry up the beans and weeds so that the farmer can combine within seven days of spraying.

In continuing the discussion of soybean defoliation, G. Megaw, London, Ohio, recommended Dow's general weed killer, a di-nitro o-sec-butyl phenol, as the best available defoliant. Summarizing comparative experiments, he said, "Apparently much larger quantities of penta would do the same job as the di-nitro weed killer. There were no experiments run to determine the lowest possible dosage that would be effective with di-nitro, but it appears that the dosage could be lowered and good results still obtained."

Liquid fertilizer was discussed by Vernon Vic, Ohio Dusting Co., Findley, Ohio; Thayer Martin, Na-Churs, Marion, Ohio; and Stanley A. Barber, Agronomy Dept., Purdue University. Mr. Barber outlined a "comparison of yield increases from soil and from foliar applications of nitrogen" and "comparison of foliar and soil applications of nitrogen for wheat." He concluded that there is no advantage for foliar application as compared with side-dressing.

J. D. Wilson, Ohio Agricultural Experiment Station, reviewed reports from station workers on tentative plans for disease and insect control by airplane application in Ohio in 1955.

The dollar damage estimates for the ten species of insects that were considered most destructive in 1954 were listed by C. R. Neiswander and

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G. E. Lehker, Ohio Ag. Station, in a report, "Evaluation of Insect damage in 1954 and Estimations for 1955." They advised that of 30 million dollars damage caused by insects in 1954, 24 million is attributed to the European corn borer, the meadow spittle bug, the corn earworm and the clover root borer.

Arthur Gieser, Beltsville, Md., discussed the highlights of the second conference on Agricultural Aviation Research, held in Chicago, Dec. 3-4, 1954. Following this report, H. H. Dodge, Shell Chemical Corp., reviewed the uses of granular insecticides and listed the following advantages of granular over other formulations: 1. Less drift during application. 2. In mosquito larvae control, the granules fall all the way through to the water surface. 3. "In treating feed or food crops or turf and ornamentals the granules are particularly well suited since they fall through the foliage onto the soil surface, thereby lessening the hazard of foliage residues." 4. In many applications a larger pay load can be carried though granules than sprays.

According to D. L. Schuder, Purdue Univ., the use of a virus disease in control of the European pine sawfly may be of commercial importance. He reported that on the 23rd day after treatment with the virus, the average mortality rate of the sawfly was 89 per cent. "According to experimental work in Canada," he stated, "the virus diseases live from year to year, and the sawfly population remains infested." However, he said, studies on this phase are as yet incomplete. Although the method is new and the virus innoculum is not yet commercially available, Mr. Schuder predicted that aerial applicators would be called on to apply the innoculum in the near future.

The opening session of the Conference, under chairman J. J. Davis, featured among other papers, "Problems and Progress of Mosquito Control by Airplane," by Bruce Brockway; and "The Future of the Helicopter in Agricultural Aviation," by Albert H. Luke.

Three special sessions of the conference covered agronomy, entomology and engineering. Respective chairmen were Howard Taylor, T. H. Parks, and R. D. Barden.★★

●

Hercules' "Delrad"

A new chemical cure for "sick" farm and fish ponds has been announced by Hercules Powder Co., Wilmington. The chemical is "Delrad" and has been found to be effective for the control of algae in farm ponds, lakes, irrigation canals, and other bodies of water. Some algae have little useful purpose and interfere with the propagation and growth of fish.

The amount of Delrad required to control algae, in a particular pond or lake, is dependent largely upon the environmental temperature. Generally, the higher the temperature the lower is the concentration required for control. The frequency of treatment is somewhat dependent on the type of the water. Hercules announces that limited amounts will be available only in the South.

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Pfizer Names Thompson

Chas. Pfizer & Co., Brooklyn, N. Y., announced last month the appointment of J. Jerome Thompson as manager of the agricultural sales division. At the same time Edwin H. Smith was named controller and Allan J. Greene director of commercial development.

Sulfate Output Dips in Canada

Factory sales of ammonium sulfate by Canadian producers in 1954 amounted to 177,699 tons valued at $7,709,668 compared with 186,540 tons valued at $8,200,124 in 1953. Exports during the year amounted to 154,760 tons compared with 147,370, and imports totaled 14,101 tons compared with 21,250 for 1953.

•

Form New Weed Society

The recently organized Weed Society of America has announced plans to hold its first annual meeting Jan. 4-6, 1956, at the New Yorker Hotel, New York. The new group was formed through the action of the Association of Regional Weed Control Conferences, after the north central, northwestern, southern and western weed control conferences directed their delegates to the association to develop the framework for organizing a national group.

Membership in the society is open to all individuals and organizations interested in furthering its objectives, which are to encourage and promote the development of knowledge concerning weeds and their control. Dues are $6.00 for 1955, which includes a subscription to the journal *Weeds*, the official publication of the society.

•

Conn. Field Day Aug. 16

The annual field day of the Connecticut Agricultural Experiment Station will be held this year on August 16 at the Station's Experimental Farm in Mt. Carmel, and will be designated as "Donald F. Jones Day." Field Day this year will highlight the research of Dr. Jones, head of the genetics department at the station, who developed in 1917 the world's first method for producing hybrid corn seed. Former vice-president and former secretary of agriculture, Henry A. Wallace, will be the principal speaker.

Inspection of field plots where agricultural research is going on, a noontime meeting with speakers, and special exhibits and demonstrations highlighting the Station's current work will make up the program. Detailed plans for the Field Day will be announced at a later date.

British Agricultural Conf.

Practical aspects of the use of insecticides and fungicides in agriculture and horticulture will be the theme of the National Crop Protection Conference to be held at Eastbourne, England, Nov. 1-3. The meeting will be sponsored by the Pesticides Group of the Society of Chemical Industry and other organizations, including the Association of British Insecticide Manufacturers. G. L. Baldit, Plant Protection Ltd., Yalding, Kent, is conference secretary.

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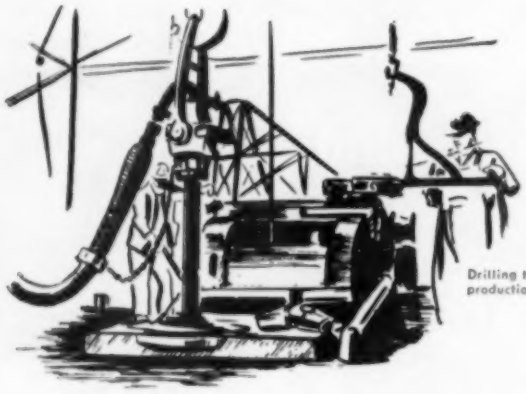

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Metalsalts Appoints Fallon

Raymond J. Fallon was recently appointed sales representative for Metalsalts Corp., Hawthorne, N.J., to handle their line of products including mercury, mercurials, and fine organics. His territory includes New England, New Jersey, and the metropolitan New York area.

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N. C. Phytopaths to Meet

A symposium on systemics and a joint program with the Ohio Pesticide Institute will be among the outstanding events at the summer meeting of the North Central Division of the American Phytopathological Society to be held Aug. 8-10 at Wooster, Ohio. An advance announcement from J. D. Wilson, Ohio Agricultural Experiment Station, reports plans for an inspection of exhibits, plot inspections and visits to outlying experiments during the conference.

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Shell Opens New NH_3 Plant

Ernest L. Peterson, assistant secretary of agriculture, was principal speaker at ceremonies marking the opening of Shell's new anhydrous ammonia facilities at Pasco, Wash. The Pasco installation and a similar one at Portland, Ore. are terminals in a new water-route distribution system, which supplies Northwest agricultural and industrial markets with anhydrous ammonia from Shell's plant at Pittsburgh, Calif.

Correction

An error in the February issue of *Agricultural Chemicals* was recently brought to our attention. The report on the elections at the annual meeting of McConnon & Co., Winona, Minn., should have read as follows: J. R. McConnon was elected chairman of the board and James McConnon was elected president.

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Fert. Project for Venezuela

Plans to build five plants in Venezuela to convert household refuse into organic fertilizer (humus) were announced recently by Hrant Adjemian of Venezuela at an Inter-American Conference held recently in New Orleans. The new plants would use the zymothermic process, a method reported to be in operation at eight plants located in France, Spain and Brazil.

Venezuela imports fertilizers worth about $1.5 million a year. Mr. Adjemian estimates that the organic products would sell at $30 a ton, yielding a profit of 30-35 per cent. As yet no reports have been issued concerning plant locations or definite financial backing for this project.

NCCA Issues Bulletin

The National Cotton Council of America recently published its official 1955 recommendations in a bulletin titled *Cotton Insect Control*. Contents include a report on the eighth annual Beltwide Cotton Insect Control Conference, precautions for handlers and users of insecticides, guides for using insecticides and a list of state extension and research entomologists. Much of the text covers state-by-state recommendations.

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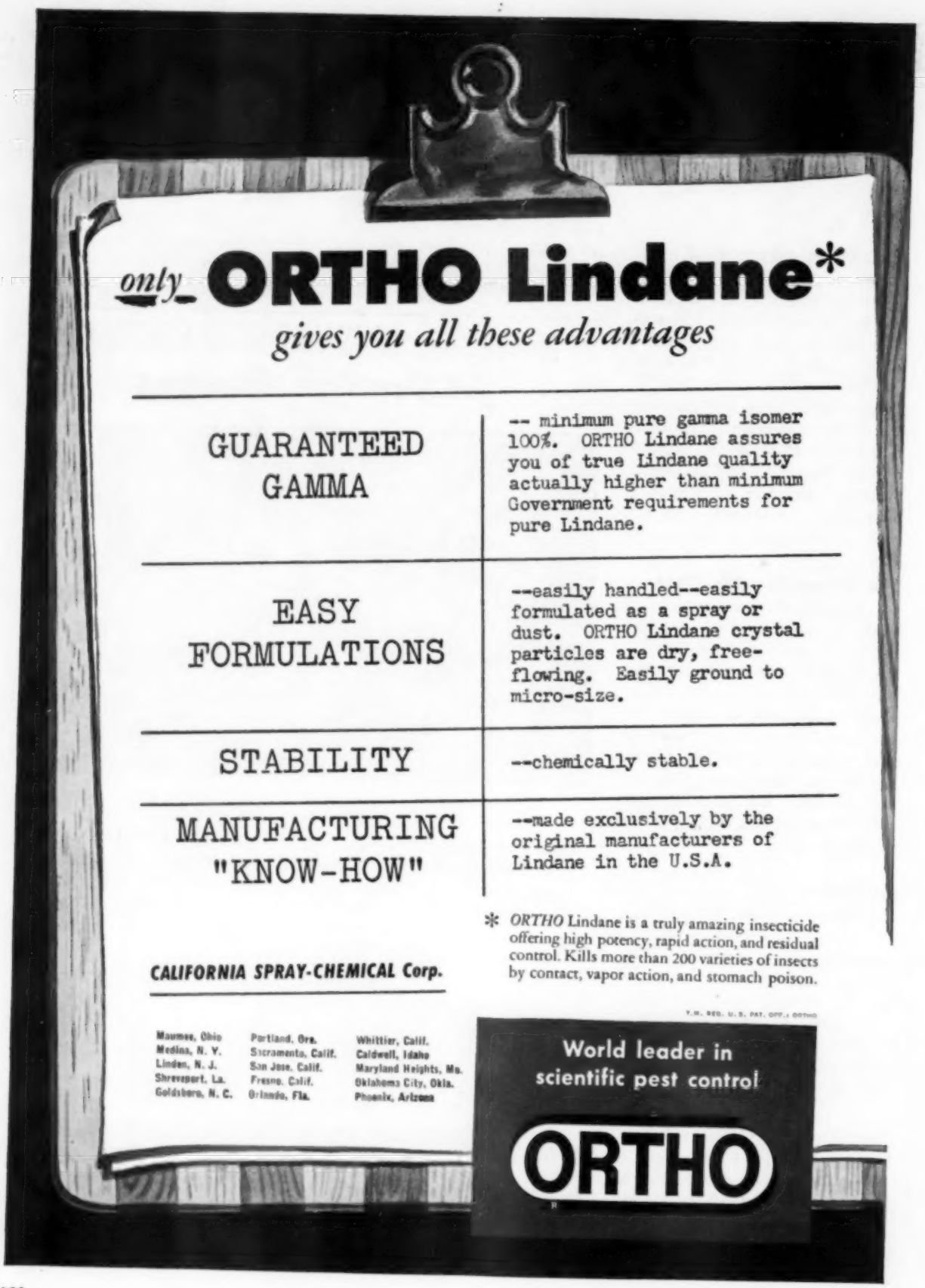
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Suppliers' BULLETINS

Fuller Roll Feeders

The Fuller Co., Catasauqua, Penn., a subsidiary of General American Transportation Corp., offers a complete line of feeders and vane - type feeders for the handling of dry pulverized and granular materials, including kaolin and lime. Some of this equipment is illustrated and described in bulletin F-5 issued by the company.

•

Announce New Spray Head

Spraying Systems Co., Bellwood, Ill. recently announced a new triple spray head (No. 6115) for use with its 1/4U VeeJet nozzles designed for use on trees with low-gallonage sprays. In addition, the company has developed a new line of nozzles and check valves for airplane spraying, offering capacities from one gallon per minute to eight gallons per minute.

•

Attachment for Row Planters

A new row planter attachment which applies dry granular insecticides as it plants has been announced by the E. S. Gandrud Co., Inc., of Owatonna, Minnesota. The new attachment mounts on either 2- or 4-row planters to place dry chemical insecticides with the fertilizer in the row.

•

Richardson Data Sheet

A new two-color data sheet, offered by the Richardson Scale Co., Clifton, N. J., describes and illustrates the company's manually-operated gross bagger. Equipped with an automatic cut-off device, this recently-developed bagging scale fills and weighs either textile or multi-wall paper bags in capacities of 50 to 140 lbs. The unit was designed to weigh fertilizer, feeds, rock products, chemcals, food products, etc.

Besides a list of features, the bulletin includes photos of the bagger, and a dimensioned engineering drawing showing top and side views. It also describes a typical bagging operation.

•

New Spray Equipment

A low cost combination field and hand gun sprayer and a new line of trailer-mounted boom sprayers have been announced by Century Engineering Corp., Cedar Rapids, Iowa.

For full killing power, your dusts and sprays need the right physical properties — to absorb and disperse the toxicant thoroughly — to make them cling, cover, and stick in doing their deadly work. Vanderbilt carriers, diluents, and dispersing agents are *specially developed* to give dusts and sprays these important physical properties that mean more efficient coverage and increased lethal effectiveness in the field.

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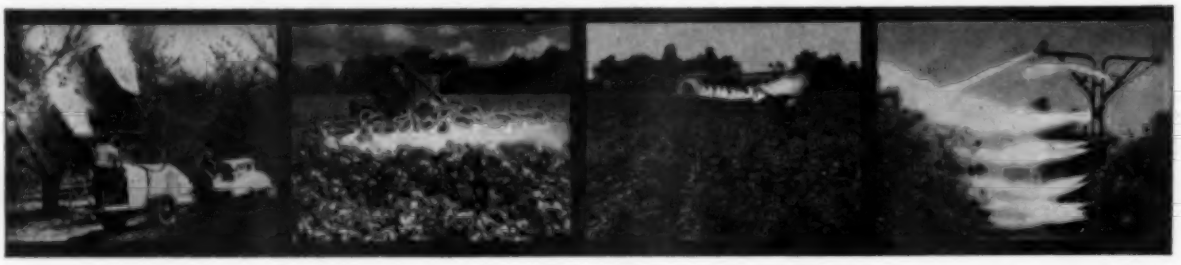

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- Wettable powders, emulsifiable and oil solutions; and dust concentrates based on our technical grade chemicals

and many other chemicals that help farmers, gardeners, cattlemen and orchardists.

New Bagging Installation

Richardson Scale Co., Clifton, N. J., report that a new weighing system installted recently at the Knoxville Fertilizer Co., Knoxville, Tenn., increased operation 100% to allow bagging of 15 100-lb bags per minute of its lightest fertilizer and 16½ 100-lb. bags per minute of a slightly heavier product. The product presented several handling problems, due to a high moisture content.

•

Hypro Portable Pump

Hypro Engineering, Inc., has developed a portable pump for clearing away accumulated rain water from septic tanks, drain fields, and various installations. The pump weighs 26 pounds, complete with motor, hinged carrying handle and a vacuum switch. Capacity is up to five gallons per minute with pressures up to 30 pounds.

•

New Metering Device

Highway Equipment Co., Cedar Rapids, Iowa has announced a "New Leader" metering device, which fits all late model "New Leader" agricultural spreaders.

The unit accurately measures the amount of fertilizer being fed to the twin distributor discs and provides a simple method of obtaining the correct feedgate setting.

•

DuPont Aerosol Herbicide

A new lawn weed killer that leaves "tracks" to show which dandelions have been sprayed has been announced by the E. I. Du Pont Co., Wilmington. Du Pont has also announced a new Garden Insect Sprayer, a multi-purpose aerosol insecticide formulation, for roses and other outdoor flowers and ornamentals.

Called "Lawn Weeder," the weed killer is an aerosol formulation of 2,4-D containing an inert white pigment which lingers on dandelions, plantains and other sprayed surfaces, long enough so the user can see where he has already sprayed. "Lawn Weeder" comes in a 12-ounce can with a polyethylene spray nozzle.

The new garden insecticide combination contains methoxychlor, lindane, and rotenone. It comes in an aerosol dispenser with a finger-tip spray valve.

It is said to be highly effective against many insect pests, such as aphids, Japanese beetle, red spider mites, leafhoppers, lacebugs, thrips, diabrotica beetles, and certain caterpillars which infest flower garden plants.

Both new products are scheduled to be in retail garden stores in time for the 1955 gardening season.

Century Reports New Sprayers

A new line of trailer-mounted boom sprayers and a combination field and hand gun sprayer are available from Century Engineering Corp., Cedar Rapids, Iowa. The combination sprayer, No. 650, features a wide coverage nozzle that will cover a swath up to 50 feet wide, spraying to both sides, or up to 25 feet wide spraying to one side. The new trailer unit, offering sprayers available in six or eight row boom sizes, will carry either a 110 or 200 gallon tank.

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Chemical Buyers to Meet

The Chemical and Allied Products Buyers' Group of the National Association of Purchasing Agents were scheduled to present a program for chemical buyers during the National Convention of the NAPA May 29-June 1, New York. Planned for the morning session was a panel discussion of "Custom Chemical Requirements and the Factors That Must be Considered in Deciding Whether to Purchase or Manufacture.", with the following participants: E. H. Doht, Mallinckrodt Chemical Works, St. Louis; E. C. Larsen, J. T. Baker & Co., Phillipsburg, N. J.; S. F. Firebaugh, Ciba Pharmaceutical Products, Inc., Summit, N. J.; and D. B. Black, Dow Chemical Co., Midland, Mich.

INSECT ACTIVITY IN U.S.

(*From Page 62*)

ern and south-central Kentucky. The glassy cutworm caused severe damage to Merion blue grass in the mountainous area of Kern and Yolo counties, California. This species seldom causes damage in California. Tennessee, Utah and other states also reported cutworm damage.

The brown wheat mite caused damage to considerable acreage of wheat in Oklahoma. Approximately 7,500 acres were treated for this pest in the Kingfisher and Garfield areas alone. Damage continued in Kansas particularly to drought affected wheat. Counts of 50 to 300 per foot of drill row were recorded in many fields. Utah also reported damage from this mite.

Cotton Pests Building Up

COTTON insect activity began to pick up rapidly the first part of May. The brown cotton leafworm, which was of concern on cotton for the first time in 1954, has reappeared in eastern and south central Texas and in Natchitoches and Bossier Parishes, Louisiana. The pest caused serious damage in one field of seedling cotton in Louisiana and was found in many fields of young cotton in the Texas areas. Severe ragging by this leafworm in some Texas areas in 1954 warranted control on several thousand acres.

Boll weevil winter survival counts in Tennessee are considered to be very low with an average of only 62 live weevils found per acre in examinations in McNairy county. Among other pests causings concern on cotton were thrips, cutworms, aphids and spider mites.

Fruit Insect Activity

FRUIT insect activity was underway by the first week of May. Codling moth adults were emerging in most of the eastern fruit areas as far north as southern New Jersey, Illinois and Indiana. First-brood larval attack is expected to be high in southern areas of the latter state. Plum curculio adults likewise were active over wide areas with some injury showing on plums in Westchester county, New York, and light injury to apples in southern Indiana. Abundant populations were recorded in Delaware, central Pennsylvania and at East Lansing, Mich.★★

WASHINGTON REPORT

(*From Page 65*)

U. S. Department of Agriculture.

6. "Four Most UnWanted Weeds in the South"—Ernest Stamper, Louisiana State University.
7. "Timing Cotton Defoliation For Greater Profit" — Dr. W. Hardy Tharp, U. S. Department of Agriculture.
8. "The Big Sneeze . . . And The Big Itch"—Mr. H. W. Kip, Hay Fever Prevention Society, New York City.
9. "Decade of Wonders"—Dr. Warren C. Shaw, U. S. Department of Agriculture.
10. "Sign of a Money Making Farmer"—Dr. W. A. Harvey, University of California.
11. "How To Apply Herbicides"—Dr. R. J. Aldrich, U. S. Department of Agriculture, New Brunswick, New Jersey.
12. "Where To Use Herbicides"—Jack Dreesen, National Agricultural Chemicals Association.
13. "Brushland to Grassland"—Dayton L. Klingman, U. S. Department of Agriculture, Columbia, Mo.
14. "Herbicides—Key to Pasture and Range Profits"—M. K. McCarty, U. S. Department of Agriculture, Lincoln, Neb.
15. "Herbicides—For Waterweed Control"—F. L. Timmons, U. S. Department of Agriculture, Laramie, Wyoming.

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NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION

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The herbicide division of the National Agricultural Chemicals Association, as well as the Association itself, and the American Plant Food Council will be hosts to the National Association of Television and Radio Farm Directors June 20, 21, and 22, when the group will be meeting in Washington. Over one hundred of the nation's leading farm television and radio directors and many of their wives are expected in Washington during the three-day meeting which includes a work session with Secretary Benson, a meeting with President Eisenhower, and a trip to the Beltsville Research Center.

Leaders of the fertilizer and pesticide industries are taking this opportunity to review latest developments in their respective fields before the Washington visitors and also to better acquaint the group with the new consolidated National Plant Food Institute.

* * *

The increased appropriations for the USDA's agricultural conservation program means there's more "elbow room" for increased application of lime. The $250 million appropriation continues for the second consecutive year of the ACP program at this dollar mark. Previously, for the 1953-54 year, the amount available was $195 million.

Of course, not all of this amount is for lime, rather the objective of the program is general conservation as adapted to local conditions. The amount which is used for lime depends largely on how the program is administered both in Washington and in the field.

Many agriculture scientists are deeply concerned over the drop in the volume of lime applied to the nation's farms. Lack of lime in many instances limits the effectiveness of fertilizer. So, better results from fertilizer can be expected as the backlog of lime requirements are met.

* * *

Continued thought is being given to the responsibilities faced by scientists in our present day society. The agricultural chemical industry, particularly pesticide manufacturers, have a tremendous stake in the intelligent direction of this development.

The pesticide industry has just gone through what some hope will be the end of a decade of increased legislative control. It should be emphasized that the industry supports wholeheartedly the well-considered efforts to develop sound legislation. If the trend toward increased legislative restrictions is continued, it may well place a part of the industry in such a position that it will not be able to afford the research and development necessary for the development of new pest control materials.

This being the centennial of the establishment of land grant colleges, it might be appropriate for this general question to be examined carefully at the next general meeting of pesticide manufacturers.★★

GHOST SPOT-GRAY MOLD

(*From Page 61*)

fungicides in the control of gray leaf spot (*Stemphylium solani*) (*Table 3*). There was also an indication that it might be effective against ghost spot. Observations on disease control in earlier trials on the guard rows, where there was an overlapping of spray materials indicated that a mixture of dichlone and zineb might be promising in the control of both gray leaf spot and gray mold. In a fall trial in 1953, a dichlone-zineb mixture (½: 1½: 100) was included to check this possibility. This mixture was more effective than dichlone against gray leaf spot, and the two fungicides were compatible with each other and with wettable DDT and/or parathion. As usual in early fall crops, neither gray mold nor ghost spot was present, therefore the effectiveness of the dichlone-zineb mixture against those diseases was not determined.

Since *Botrytis* spores are produced in such huge quantities and are easily wind-borne, they could be disseminated over the small standard-sized plots from adjacent heavily infected plots, thereby reducing the apparent effectiveness of a fungicide. To obtain more accurate information on gray mold, a trial was conducted in the winter of 1953-54 using large,

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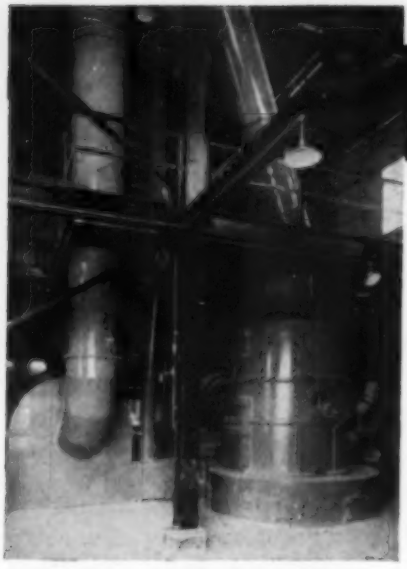

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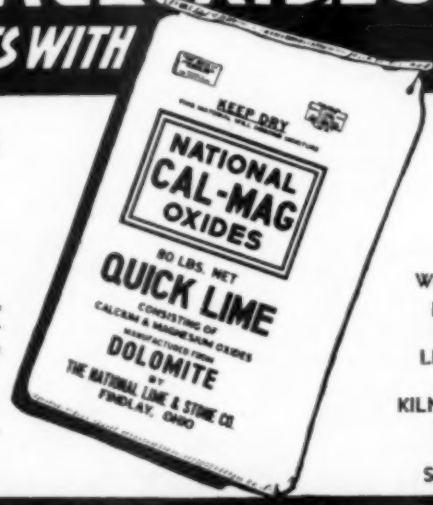

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TABLE 1.

The relative effectiveness of various fungicide formulations on the control of gray mold and ghost spot of tomatoes in large plots (0.41 acre per treatment) when the infection levels remained low. Trials in winter of 1953-54.

Material and dosage	Gray mold				
	Percent plants showing	Foliage index[a]	Percent fruit harvested	Percent fruit harvested	Percent fruit[b]
Dichlone ¾-100	0.00	0.00	0.03	0.03	15.00
Zineb 2-100	75.58	0.83	0.70	1.49	55.00
D-Z mixture 1⅜: 100[c]	0.00	0.00	0.25	0.21	23.00
D-Z-N-M-C alternate	18.30	0.28	0.35	0.30	37.00
Zineb-PCNB alternate 2: 100[d]	43.30	0.43	0.31	1.00	40.00
No fungicide	0.00	0.00	0.00	0.76	5.00
L.S.D. at 5%	26.30	0.39	0.31	0.95	15.95

[a] Figures based on following ratings: 0=minimum; 5= maximum.
[b] Data collected 1 week after last harvest and 12 days after last fungicide application. Fruits selected from 1 to 1½ inches in diameter.
[c] Wettable powders of D (dichlone) and Z (zineb) were mixed at the ratio of ¾:1, respectively.

TABLE 2.

The relative effectiveness of various fungicide formulations on the control of gray leaf spot, the size of the vine, and yield of tomatoes in large plots (0.41 acre per treatment) when the infection levels remained low. Trials in winter of 1953-54.

Material and dosage	Gray leaf spot severity[a]	Density and size of vine[a]	Yield in marketable bu./acre
Dichlone ¾: 100	1.37	4.50	147.20
Zineb 2: 100	0.56	4.19	139.03
D-Z mixture 1⅜: 100[c]	1.00	4.25	142.16
D-Z-N-M-C alternate[d]	0.81	4.38	156.11
Zineb-PCNB alternate[e]	1.62	3.81	130.11
No fungicide	3.62	3.12	43.23
L.S.D. at 5%	0.71	0.52	34.58

[d] N (nabam) zinc sulfate 2 qts.:¾ lb. 100; M (maneb) 1½: 100; C (Cop-O-Zink) 6: 100. The alternate schedule of application was: Z-Z-M-M-C-N-D-D-N-D-M-N-M-D-D-M-D-D-D-Z-Z-D-Z-D.
[e] PCNB (75% wettable pentachloronitrobenzene). The schedule of application was: Z-Z-Z-Z-Z-Z-PCNB-PCNB-Z-Z-Z-Z-PCNB-Z-PCNB-Z-Z-PCNB-Z-Z-Z.

8-row plots. Each of the 8 rows was sprayed, but data were taken from the 2 center rows. The data from this large-plot trial are presented in Tables 1 and 2. It should be noted that the incidence of gray mold and ghost spot was quite low; this should be considered in interpreting the data. As shown in Table 1 dichlone. dichlone-zineb mixture, and dichlone alternated with other materials reduced the amount of gray mold and ghost spot below that of zineb-treated plots. The dichlone-zineb mixture and dichlone alternated with other materials also gave a better control of gray leaf spot than did dichlone alone (Table 2).

It has been noted that where defoliation or a reduction in density and size of tomato plants was found, there was corresponding reduction in the severity of gray mold. Thus, the unsprayed check plots and the plots sprayed with materials ineffective against the leaf-spotting diseases usually had the least amount of gray mold, probably because defoliation permitted more air and sunshine to penetrate and dry out these plants, making conditions unfavorable for the development of gray mold. The data presented in Table 2 were collected to show whether reduced amount of gray mold resulted from defoliation caused by leaf-spotting diseases, or from control by the fungicide. These data show no correlatoin between treatments containing dichlone and reduction in the density and size of plants. Neither do they show

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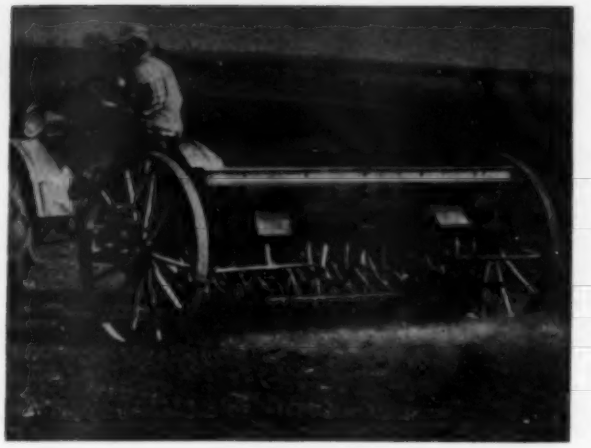

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any reduction in yield. They do show that the apparent control of gray mold and ghost spot obtained with the zineb-PCNB alternate and the smaller amounts in the unsprayed check plot could result from lack of control of the leaf spotting diseases.

To summarize, in fungicide trials conducted over a 3-year period (1951-54), 50% wettable dichlone (¾: 100) was the most effective material tested for the control of both gray mold and ghost spot; however, it was ineffective against gray leaf spot. This lack was largely overcome by alternating dichlone with zineb, nabam-zinc sulfate, or maneb. Mixtures of dichlone and zineb (½: 1½ 100; ⅜: 1: 100) were found to be promising in the control of gray mold, ghost spot, and gray leaf spot.★★

Material and dosage	Percent fruit showing Gray mold 1951-52	Gray mold 1952-53	Ghost spot 1952-53	Incidence of gray leaf spot[a] 1951-52	1952-53
Dichlone ¾: 100	0.00	0.97	0.50	8.17	23.50
Nabam-Z_nSO_4 2 qts.: ¾ lb.: 100	10.80	10.41	1.33	2.15	0.50
Zineb 2: 100	1.30	5.07	2.12	4.42	1.50
Maneb 1½: 100	11.30	8.55	1.91	4.27	0.75
No fungicide	0.00	0.92	2.23	34.85	57.87
L. S. D. at 5% for 9 treatments	3.20			9.58	
13 treatments		2.28 N.S.D.			13.04

[a] The figures for 1951-52 represent the average number of gray leaf spot lesions per leaf, while those for 1952-53 are the estimated percentage defoliation due to gray leaf spot.

TABLE 3. The relative effectiveness of a selected group of fungicide formulations on the control of gray mold, ghost spot, and gray leaf spot of tomatoes in small plots (0.036 - 0.038 acre per treatment).

ECONOMIC PEST CONTROL

(*From Page 41*)

the soil have given protection. This has insured the grower of a good stand of plants as well as a profitable yield of fruit.

Many small, unnoticed insects of all types spend part or all of their life in the soil but apparently do considerable damage to plants. Dr. A. L. Dugas (1) reported on the increased yield of sugarcane when protected from soil insects and related pests as springtails, bristletails, centipedes, millipeps, and earwigs. Sufficient data is available to recommend one application of chlordane at the rate of 2 pounds per acre to be applied on the cane seed pieces in the open furrow shortly before covering with soil. The total cost of insecticide application is estimated at $4.50 per acre which gives an annual average gain from increased yield of about $16 to $18 per acre. Based upon 30 tests over a 6 year period, a single application of chlordane increased the average yield of plant cane per acre by 2.8 tons. Further tests to study the carry-over effect of chlordane into the second year after application revealed an average increase in cane yield of 2.5 tons the first year and 2.7 tons the second year.

Some insects spend part of their life development, such as the pupal stage of the plum curculio, in the soil. During the pupal development no injury occurs to the plant. Tests are now in progress for the control of these pests by adding insecticides to the soil and the results indicate the possibility of control with very low dosages per acre.

The increase in yields by the use of soil insecticides has been outstanding for many crops. The cost of the control is small in comparison to the increased profits resulting from this control program.

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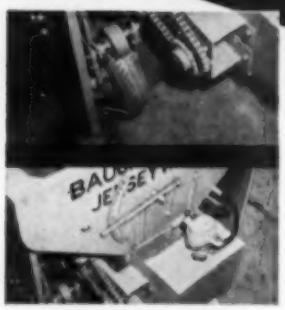

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Bibliography

(1) Dugas, A. L., 1954. Soil treatment with chlordane to increase sugarcane yields on heavy soils. Louisiana Agricultural Experiment Station, 6 pages.

(2) Leach, B. R., 1926. Experiments with certain arsenates as soil insecticides. *Journal of Agricultural Research*, 33, p. 1-18.

(3) Lilly, J. H., 1955. Soil insecticides as crop insurance. Paper given at National Agricultural Chemicals Association Meeting in St. Louis, Missouri on March 8, 1955.★★

ARKANSAS-PANAMA

(*From* Page 44)

ucts to the central facility. Specific recommendations based on this research were made to the Ministry of Agriculture.

Home demonstration clubs are serving as a basis for improvements in the health and well being of the rural people. Although founded less than two years ago, the Extension service has more than 500 members in these clubs. The homemakers are carrying on such simple projects as washing dishes and cooking utensils in hot water, raising vegetables in home gardens, using native fruits in their menus, making simple stoves to elminate cooking on the floor. Simple as these projects are, the improvement in the health and well being of the rural people would be remarkable if they were adopted in all of the rural homes in Panama.

As in all countries, the future of Panama depends on the development and training of the younger generation. Panama is spending more than 20 per cent of its national budget in educating the young people. Now through the organization of 4-S Clubs, the same as United States 4-H Clubs, by the Agricultural Extension agents, many young people are working on projects with swine, calves, or chickens or gardening, or sewing or in fertilization of crops. Although less than 2 years old, there are now 56 clubs with 1592 members. The accomplishments of these young people are best described in the words of the Minister of Agriculture as he saw demonstrations conducted less than four months after the first clubs were formed, "It is fantastic." Truly Panama has the basis for a strong agricultural economy.★★

GEORGIA STATION

(*From Page* 45)

The Lab Goes to The Farm

SOIL testing laboratories are operated at four stations; each of these stations has a mobile unit which is scheduled in the counties of the state through the local county agent. These laboratories and mobile units are testing soils in all countries of the state. The mobile units are soil testing laboratories on wheels, making it possible to carry the laboratory to the farmers. These laboratories and mobile units are saving the farmers of the state millions of dollars annually through the more efficient use of commercial fertilizers. For example, we have found some soils in the mountain area of the state where increases in yields of corn of as much as 800 per cent have been realized by adding small amounts of phosphorus. Soils are tested for nitrogen, phosphorus, potash, and calcium. Recommendations are made on the basis of the field history, the soil analysis and the requirements of the crop to be planted.

Extensive research is being conducted on ways and means of increasing economical crop yields through better fertilizer practices. Based upon experiment station tests and results of many leading farmers, the agricultural income of Georgia could be increased $260,000,000 annually through more adequate and effective use of commercial fertilizer.

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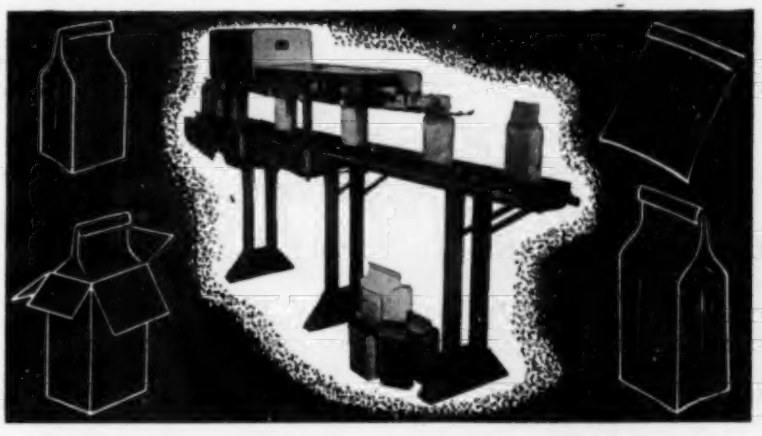

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Chemistry and Uses of Insecticides

by E. R. de Ong

445 pages, $6.75—This book covers all the major insecticidal agents in detail, describing not only their chemical nature and properties, but also their specific action on various types of insects, their methods of application, and their effect on animals and humans.

Phosphates in Agriculture

by Vincent Sauchelli

175 pages, $2.75—It deals with the subject of rock phosphate versus superphosphate and colloidal phosphate; with the origin of phosphorus, the mining and processing of the phosphate rock, granulation of superphosphates, fixation of phosphates in the soil, losses of phosphorus and replenishments, phosphorus in nutrition, radioactive phosphorus, basic slag, fused and sintered phosphates and TVA research data on phosphates from field tests in 13 states.

Manual on Fertilizer Manufacture

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Handbook of Agricultural Pest Control

by S. F. Bailey and L. M. Smith

190 pages, $3.25—A practical handbook for the custom spray operator, the pest control operator, farm advisor, agricultural chemical salesman and field worker. This handbook covers the agricultural chemicals (insecticides, fungicides, herbicides, plant hormones and nutrient sprays, defoliant, etc.), their rates of application, useful formulas, as well as chapters on fumigation, spray machines, toxicology, dusts and dusting, aircraft, and mosquito control.

Insect Control by Chemicals

by A. W. A. Brown

817 pages, $12.50—This text classifies the insecticides and gives their chemical, physical properties; discusses the hazards to avoid in formulation, mixing and use of compounds; and illustrates modern application equipment.

The Chemistry and Action of Insecticides

by H. E. Shephard

504 pages, $7.00—This new book gives a vast wealth of information on insecticides—their chemical, physical, and toxicological aspects. Covers these chemical groups: Arsenical Compounds; Fluorine Compounds, Sulphur Compounds; Copper Compounds; Inorganic Substances; Nicotine; Rotenone; Petroleum, Soaps, Creosote; Synthetic Organic Insecticides.

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1071 pages, $10.00—This authoritative guidebook covers hundreds of both useful and destructive insects—treating the inner and outer structure and form of general species. Here are descriptions of more than 500 types of insect pests of the U. S. and Southern Canada.

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520 page, $9.80—Here is a complete analysis of the relationship between crops and phytophagous insects together with a full analysis of the insect resistant varieties of important crops, such as wheat, corn, cotton, sorghums, potato.

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ments resulting in an increased yield of 2½ million bushels. They have found that seed treatment on oats has increased the yield by 18 per cent. This practice is followed throughout the state and is providing increased winter grazing and larger yields of grain.

Minor Elements

TRACE or minor elements have been supplied incidentally in the past. Copper, iron, zinc, boron, manganese, and molybdenum are some of the trace elements known to be required by plants. It is found that the addition of zinc sulfate to the soil is necessary for succesful corn and pecan production on some of the light Coastal Plain soils. Boron in the form of borax is now customarily applied to the soil for the production of alfalfa and clover seed. Crop response to the application of copper in the form of sprays and dusts has been obtained and the addition of iron in ground glass or in complex organic compounds such as chelates to the soil around azaleas, camellias, rhododendrons and blueberries has given positive results in preliminary tests.

What About the Weather

DURING the past three years, unprecedented interest has developed regarding the use of supplemental irrigation. The annual rainfall in Georgia is roughly fifty inches, but poorly distributed as far as present crop production practices are concerned. Several periods of water stress are experienced during each crop year. Research results for the past several years show that the yield of tomatoes may be increased three times, corn ten times, snapbeans nine times, tobacco thirty per cent, and cotton 250 per cent by the use of supplemental irrigation. In some of these tests irrigation meant the difference between a good yield and no crop.

There are many questions about irrigation which must be answered. Much more extensive data are needed on crop response, cost of applying water, amount and time of application and many other problems. It is apparent, however, on crops which have a high money value per acre that supplemental irrigation holds great promise. Its more extensive use should expand the market for commercial fertilizers.

Georgia entomologists and plant pathologists have many projects in which they are evaluating various chemical compounds and formulations relative to insecticidal and fungicidal effectiveness. These researches are revealing information to our farmers which is enabling them to be more efficient producers of food, feed, and fibre crops.★★

FERTILIZER CAKING

(*From Page 42*)

chloride needles was found on granules that had been dried at the highest temperature. If sublimation were taking place, this is what one would expect to happen.

2. The second method is to assure that the granules are kept perfectly dry. The drying temperatures used by the British manufacturers are between 250° and 580°F. These temperatures seem high enough but, the author says, it is possible that not enough time was allowed to produce a thorough drying, and some moisture may have been trapped inside the granules. A possibility also exists that crystalline hydrates of calcium sulfate of the superphosphate may have retained some water. Higher drying temperatures than those previously mentioned are not recommended, since they would increase the concentration of ammonium chloride on the granule surfaces. It is much more advisable to increase the drying period.

Unfortunately, we know that when the period of drying is increased the rate of output is decreased and this increases unit cost of production. However, it is the production manager's job to balance one economic factor with another and by compromise reach a satisfactory end product.

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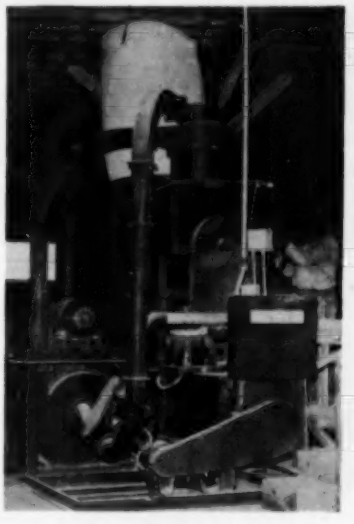

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British practice is to use sulfate of ammonia as the source of nitrogen; they do not ammoniate with aqua ammonia or the nitrogen solutions commonly used in American practice. However, this analysis of the cause of caking in granulated mixed fertilizers suggests possible lines of study by our production personnel. Ammonium chloride crystals can be formed as indicated even by American practice.★★

ENFORCEMENT PROBLEMS

(*From Page 35*)

only the meter readings with the net gallonage, but also all the other information required to label a fertilizer correctly.

Each year during the spring, complaints are received throughout the country concerning itinerant peddlers of lawn materials purported to be fertilizers. The peddlers usually call their materials fertilizer when they are making a sales talk, but when they present the bill for their services it specifies lawn dressing or some other similar term to get away from leaving evidence that can be used against them for having illegally sold a fertilizer. In many cases, these materials have value as a source of mulch and may aid as a soil conditioner, but frequently an exorbitant price is charged. In one case we investigated, a bill for $750 was presented for lawn dressing the grounds of a hospital. The material applied was ordinary peat which had been purchased for a few dollars from a nearby deposit. It was being sold at the rate of 75c a bushel basket. No count was kept of the number of baskets full of peat applied to the lawns and grounds of the hospital, but the sellers claimed 1,000 baskets had been applied. When the peddlers became threatening, the bill was finally settled for $375, which was over ten times the actual value of the material. The superintendent was still not satisfied and called the enforcement agency, but by that time the peddlers had moved on to other territories.

A requirement that each peddler or solicitor for sale of fertilizers be required to have a fertilizer salesman's license which could be revoked for cause, is an aid in preventing home owners from being victimized by itinerant peddlers. It is much easier to prove that an individual does not have a proper license than it is to prove extravagant claims which have been made orally.

Each year at the annual meeting of the Association of American Fertilizer Control Officials, various problems having to do with enforcement of the fertilizer laws are discussed and recommended policies developed. One evening session is known as the States Relations Committee Meeting, which is open both to members of the association and industry representatives, as well as anyone else who is interested. Records are not kept at this meeting, but various problems are discussed from various viewpoints in order to develop uniform understanding of problems and their solution.★★

FUNGICIDE TEST

(*From Page 59*)

application protectant spray schedule to control foliage diseases: Tribasic copper sulfate (4 lb./100 gal.), maneb (2 lb. of 50%), and zineb (2 lb.). In a test where *Stemphylium solani* gray leafspot

Fungicide[a]	Concentration lb./100 gal.	Order of Disease Control: Anthracnose	Order of Disease Control: Early Blight	Experimenters' Preference
Manzate[b]	1.5	1	1	1
Dithane Z-78[b]	2	3	2	1
Tribasic Sopper sulfate[b]	4	6	4	2
Phygon XL[b]	1	4	6	3
Orthocide 50W	4	2	5	2
Tennam	2	5	3	—

[a]Four applications at 10-day intervals.
[b]Caused blossom drop.

TABLE 45

Ratings of fungicides tested as protectant sprays for control of early blight and anthracnose of tomatoes (13).

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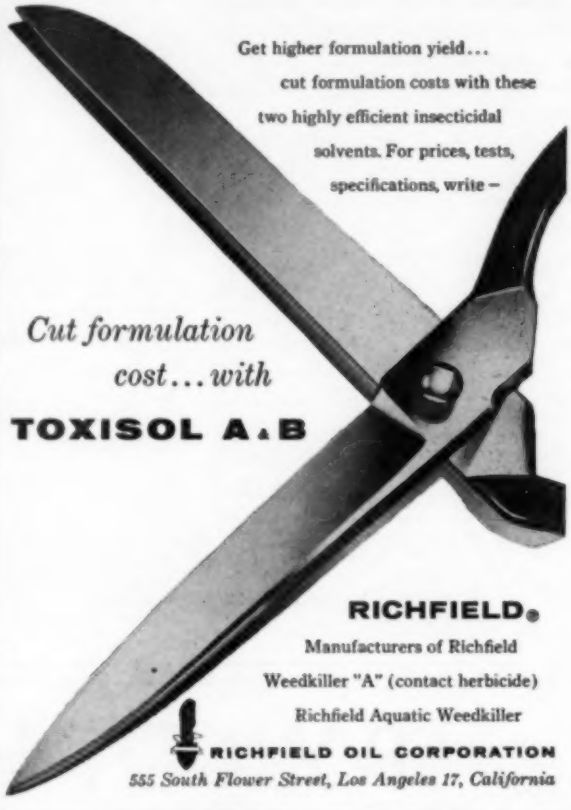

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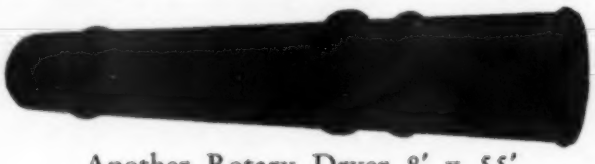

Another Rotary Dryer 8' x 55' recently shipped to a mid-western fertilizer manufacturer

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was the only leaf disease present, maneb and B-622 (3 lb.) gave better disease control than did zineb, captan (2 lb.) or tribasic copper sulfate (45).

Summary

ORGANIC protectant sprays containing captan, dichlone, glyodin, or ferbam were more effective than was sulfur in the control of apple foliage and fruit diseases. In Middle Atlantic States, Tag, alone or with either glyodin or captan, Puratized Apply Spray, and sulfur were effective as pre-pink sprays. Sulfur, Karathane, and captan controlled apple powdery mildew in the Far West.

Fire blight of pear and apple was controlled by Agri-mycin and Streptomycin as well as by Bordeaux mixture and COCS in the South, Far West, and in the Middle Atlantic States. Zineb was ineffective. The antibiotics, while effective, are currently too expensive for most growers, and there is evidence of mild toxicity to some apple varieties.

Captan or sulfur protected peaches in the South from brown rot and anthracnose. Maneb was phytotoxic, and glyodin, dichlone, and Vancide M were ineffective against peach scab. When used as post-harvest treatments, Dowicide A, sulfur dust plus tetrachloroethylene, captan, Isothan Q15, tetrachloroethylene, and Shell AL 126 gave good control of brown rot and Rhizopus rot of stored peaches. An eradicant spray of ziram, dichlone, or nabam controlled peach leaf curl in California.

Coryneum blight of almond was best controlled by captan, ziram, or maneb. Walnut bacteriosis was checked by Agri-mycin as well as by copper compounds. Wettable sulfur controlled Monilia pod rot of cacao, and was not as injurious as either yellow cuprocide or zineb.

Ferbam and Coro-SDD controlled black raspberry anthracnose and black rot of grapes in the Midwest, while dichlone, captan, maneb, and ferbam were used successfully in Washington against anthracnose of red raspberries. Glyodin, LO-738, and zineb were not effective against anthracnose. Maneb, ferbam, and captan controlled blackberry leafspot in the South. Captan and Crag 5400 were effective against grey mold rot of table grapes, while Fusarex and B-622 were ineffective. C. and C. 224 and Good-rite SDD as fungicide dips best controlled strawberry grey mold in storage.

Compounds containing mercury or cadmium usually controlled turf diseases caused by soil-borne microorganisms better than did organic compounds which contain neither mercury nor cadmium. However, thiram was effective against snow mold in England, and Thiram, actidione, and Vancide 51 controlled dollar spot in New Jersey. None of the last 3 was effective against copper spot. Actidione gave but poor dollar spot control in rye grass plots in Georgia.

Most effective corn and soybean seed-treatment chemicals in Ontario were those containing captan, dichlone, Vancide 51, B856C, and Panogen. Best control of seedling diseases of oats in Iowa was obtained with Ceresan M, Puratized C4-10, captan, Arasan SFX, Setrete, or DuPont 244. Ceresan M, captan, Panogen, and Arasan SFX were effective flax treatments.

PCNB soil treatment controlled Southern blight of tomato, garlic white rot, and damping-off and sore shin of cotton. Also, PCNB—captan or maneb or zineb soil treatments were effective against cotton sore shin in the West.

Blue mold of tobacco in Florida was controlled by zineb and LO-738 dusts, and in South Carolina, the disease was controlled by sprays with ferbam, zineb, Vancide F-956, and Agri-mycin. In Pennsylvania, Agri-mycin controlled tobacco wildfire, while Bordeaux mixture proved phytotoxic and failed to control the disease.

Root knot and root rot of tobacco in South Carolina were controlled in the field by soil treatments with ethylene dibromide or DD Mixture and in seedbeds by soil treatments with methyl bromide or urea-cyanamide or cyanamide-ethylene dibromide.

Dipping gladiolus corms in a Tersen-Heptachlor mixture controlled bacterial scab, while Emmi 10% Emulsifiable or DuPont Liquid Seed Disinfectant or New Improved Ceresan controlled Fusarium dry rot when used as dips.

Tank mix zineb best controlled rust and petal spot of Aster, and Parathion was effective against the chrysanthemum foliar nematode. Best protectant sprays for roses were those containing 1 of the following: maneb, captan, ferbam, glyodin, dichlone, or copper dihydrazinium sulfate. Maneb and zineb were best for controlling carnation blight and snapdragon rust.

Semesan, captan, thiram, DuPont I and D, MEMA, dichlone, chloranil, Fermuline, Setrete, Ethyl B856, and Panogen usually were successful as seed treatments to control damping-off of vegetables. Pelleting onion seed with either Thiram or captan along with Heptachlor or Dieldrin controlled smut disease and onion maggot in New York and Minnesota.

Protective sprays containing maneb, zineb, or tri-basic and zineb were effective against downy mildew and anthracnose of cucurbits. Maneb, organic copper compounds, or Karathane controlled powdery mildew of cucurbits.

Tri-basic or maneb or a copper-manganese mixture controlled downy mildew of lima beans on Long Island, and maneb or captan or nabam controlled downy mildew and blast of onion in New York.

Sprays with maneb, Tennam 10, LO-738, SDD plus zineb, or SDD plus zinc sulfate protected potatoes against early blight. Maneb, zineb, and tri-basic were effective against tomato anthracnose and early blight. In Florida, late blight of tomatoes was controlled by one of the following: zineb, maneb, LO-738, nabam plus zinc sulfate, and nabam plus manganous sulfate. Maneb or B-622 gave better control of tomato grey leafspot than did zineb, captan, or tri-basic.★★

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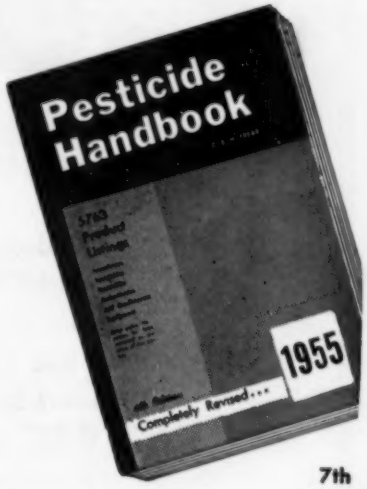

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Dr. Donald E. H. Frear, Editor of PESTICIDE HANDBOOK 1955, is one of the leading authorities on the chemistry of pesticides. He is the author of "Chemistry of Insecticides and Fungicides," the first book dealing with this subject published in the United States. In addition, he has written several other books, including "Chemistry of Insecticides, Fungicides, and Herbicides." Dr. Frear is Professor of Agricultural and Biological Chemistry at The Pennsylvania State University.

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A "Hexteel" safety floor armor which weighs less per square foot and has a greater exposed steel surface than previous models has been developed by Klemp Metal Grating Corp., Chicago. The new flooring weighs 1.7 pounds per square foot and has exposed steel surface armor of 18.15 square inches per square foot.

•

Soil Measurement Catalog

A new catalog has been issued by Industrial Instruments, Inc., Cedar Grove, N. J., on soil moisture measurement and irrigation control. The catalog describes in detail the various methods of soil moisture and fertility measurements based upon the newly devised electrolytic conductivity principle.

•

Grace Revises Data Sheets

Revised product data sheets for powdered and pelleted vanadia oxidation catalysts and silica gel have been published by Davison Chemical Co., division of W. R. Grace Co., Baltimore. They may be obtained from the division's technical service department, Baltimore 3, Md.

•

Shipping Container Directory

The 1955 directory of the Steel Shipping Container Institute of New York City lists the various users of steel containers by the chemical industry and types of containers required. The directory reports that linings are receiving a great deal of attention from the container industry. Vulcan Steel Container Co., Birmingham, Ala., is listed as one of the members of this institute.

•

Union Carbide Offers Film

"Prevent Crabgrass and Other Weeds with Crag Herbicide-1," a slide film in sound and color, is available from Crag Agricultural Chemicals, Carbide and Carbon Chemicals Co., Division of Union Carbide and Carbon Corp., Long Island City, N. Y. The new film illustrates elimination of crabgrass while seeds are still in the early sprouting stage.

Chilean Nitrate Industry at Crossroads

ALTHOUGH the nitrate industry in Chile faces no immediate crisis, reports from that country indicate that unless government legislation is revised to encourage capital investment, the industry will in time collapse, states the *Wall Street Journal* in an article in its issue of April 11th, 1954, reviewing the problems confronting the Chilean nitrate industry. The Anglo-Lauturo Nitrate Co., a firm composed for the most part of American interests, has $80,000,000 invested in Chilean nitrate mining and is willing to add another $25,000,000 anytime the government will relax its control over economic operations to allow for realistic exchange rates, amortization of capital and reasonable profits.

The seriousness of the situation was finally recognized last December by President Carlos Ibanez and his ministers of finance, when they signed an agreement with representatives of the nitrate industry in the form of a referendum providing for such reforms. However, the bill is still pending in the Chilean congress, where it is believed anti-American sentiment will prevail over a realistic approach to the problem. The left-wing element is firmly united against any encouragement of American investments and even the moderates suspect that Americans will invest only where there is a probability of large, quick profits.

From a short-sighted point of view defenders of the status quo have an additional argument in the fact that the nitrate industry continues to show a good annual profit, in spite of obsolete machinery, a dearth of research and a general inertia.

Chile, which once had a monopoly on world production of nitrate, now produces only 1,500,000 tons out of the 34,000,000 used annually throughout the world. But, despite its higher price, the natural product found in Chile is considered by many to be superior to the more extensively used synthetic nitrate. Consequently, it is believed that with investment and promotion Chilean nitrate could again dominate the world market. Another possibility which Anglo - Lautaro would like to realize as soon as circumstances permit is commercial development of nitrate by-products, particularly nitrate of potash, for which there is a large demand, currently, thereby lowering the cost of production of the main product, and as a result, the price.

Attractive as these potentialities of expansion are, Anglo-Lautaro is more interested at the present time in replacement of obsolete machinery. "Inefficient use of equipment that belongs in a museum" was the way one observer characterized operations at Pedro de Valdivia, site of what the Chileans refer to as the "new" plant —a mere twenty five years old. At Maria Elena, another mining center, steam engines that were built before the first world war are still in use, the newest one dating back to 1946.

How long this situation can continue without crippling the industry is difficult to determine, since it will depend on how much faith American investors have in the Chilean government's ability to act wisely. And here opinion is divided. Some look apprehensively at the continual cabinet shuffles and concomitant aspects of instability, while others, citing the December agreement, find cause for optimism.

What is certain, though, is that if the government refuses to act and profits show an ominous decline, American and British capital will be frightened to greener pastures with catastrophic consequences for the Chilean economy.

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Journal of Agricultural and Food Chemistry	Paid	Not
Farm Chemicals	Free	B.P.A.
Croplife	Free	Not

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Index to ADVERTISERS

American Agricultural Chemical Co. 73
American Cyanamid Co. 32
American Potash & Chemical Corp. 58
Andrews, W. R. E. Sales, Inc. 105
Antara Chemical Div., General Dyestuff Corp. .... May
Ashcraft-Wilkinson Co. 17
Atlantic Refining Co. 29
Atlas Powder Co. 74
Attapulgus Minerals & Chemicals Corp... 3

Bagpak Div., International Paper Co..... 31
H. J. Baker & Bro. 66
Baughman Mfg. Co. 120
Bell Clay Co. 124
Bemis Bro. Bag Co. 16
Bennett Industries .... May
Berkshire Chemicals, Inc. 115
Bowser, Inc. .... May
Bradley & Baker .... May
Bradley Pulverizer Co. 116
Burlap Counsel of the Indian Jute Mills Ass'n. .... May

California Spray Chem. Co. 108
Chemagro Corp. 71
Chemical Construction Corp. 15
Climax Molybdenum Co. 54
Cohutta Talc Co. 130
Columbia Southern Chem. Corp. 27
Commercial Solvents Corp. 26
Combustion Engineering, Inc. Raymond Division 14
Continental Can Co., Shellmar Betner Div. 98
Cox, Dr. Alvin J. 129

Davies Nitrate Co., Inc. 113
Davison Chemical Co., Div. of W. R. Grace & Co. 60
Deere & Co., Grand River Chem. Div..... April
Diamond Alkali Co. 110
Doane Agricultural Service, Inc. 128
Dorr-Oliver Co. 77
Duval Sulphur & Potash Co. 17

Eagle-Picher Co. 118
Eastern States Petroleum Co. .... May
Emulsol Corp. .... May
Exact Weight Scale Co. .... May

Fairfield Chemical Div., Food Machinery & Chemical Co. 90
Floridin Co. 24
Fry Co., Geo. H. 121
Fulton Bag & Cotton Mills 20

General American Transportation Corp. 72
General Chemical Division, Allied Chemical & Dye Corp. .... May
Glendon Pyrophyllite Co. 125
Grace Chemical Co. 64
Grand River Chemical Division of Deere & Co. .... April
Greeff & Co., R. W. .... May

Hammond Bag & Paper Co. .... May
Hardinge Co. 107
Heckathorn & Co. .... April
Hercules Powder Co. .... 4th Cover
Huber, J. M. Corp. 10
Hudson Pulp & Paper Corp. .... May

International Minerals & Chemical Corp. 11, 80
International Ore & Fertilizer Corp..... 120

Jefferson Chemical Co. 56
Johns-Manville Co. .... May
Johnson, C. S. C. & Co. .... May

Koppers Co. 118
Kraft Bag Co. 22

Lancaster, Allwine & Rommel 130
Lion Oil Co. 13
Ludlow-Saylor Wire Cloth Co. .... May

Mackwin Co. 82
McLaughlin Gormley King Co. 124
McDermott Bros. Co. 126
Michigan Chemical Corp. 83
Mine Safety Appliances Co. .... May
Monsanto Chemical Co. 28

National Agricultural Chemicals Ass'n. 114
National Lime and Stone Co. 116
Naugatuck Chemical Division, U. S. Rubber Co. .... May
Nelson, Edward S., Ltd. 119
Neville Chemical Co. 97
Niagara Chemical Div., Food Machinery & Chemical Co. .... April
Nitrogen Div., Allied Chem. & Dye Corp. 7
Northern Chemical Industries, Inc..... 112

Oldbury Electro Chemical Co. .... May
Olin Mathieson Chemical Corp. .... 2nd Cover, 76
Omega Machine Co. 50

Pacific Coast Borax Co. 12, 30
Page & Co., Inc., Chas. 124
Penick, S. B. & Co. .... May
Pennsylvania Industrial Chemical Corp. 18
Pennsylvania Salt Manufacturing Co. 52
Phelps Dodge Refining Corp. 111
Phillips Chemical Co. .... April
Planters Fertilizer & Phosphate Co. 126
Potash Company of America .... 3rd Cover
Potash Import & Chemical Corp. 84
Poulsen Co. 103
Prentiss Drug & Chemical Co. 96
Private Brands, Inc. .... May

Raymond Bag Co. 9
Raymond Division, Combustion Engineering, Inc. 14
Refined Products Corp. 4
Republic Steel Corp. 66
Renneburg & Sons Co., Edw. .... May
Reideburg, Theodore Associates 129
Richfield Oil Co. 126
Rohm & Haas Co. 88

Sackett & Sons Co., A. J. 23
Shell Chemical Co. 6
Southeastern Clay Co. 128
Southwest Potash Corp. 21
Spencer Chemical Co. 19
Spraying Systems Co. 130
Squibb Taylor Inc. .... May
St. Regis Paper Co. 78
Standard Agr. Chemicals Inc..... May
Stauffer Chemical Co. 101
Stoker Co., H. S. .... March
Sturtevant Mill Corp. .... May
Summers Fertilizer Co., Inc. 112
Summit Mining Corp. 117
Synthetic Nitrogen Products Corp. 63

Tennessee Corp. 100
Texas Gulf Sulphur Co. 106
Thomas Alabama Kaolin Co. .... May
Tobacco By-Products & Chemical Corp. 92
Townsend, Dr. G. R. 129

Ultra Chemical Works, Inc. 128
Union Bag & Paper Corp. .... May
Union Special Machine Co. 25
Union Standard Equipment Co. 128
United Chemical Co. .... April
United Clay Mines .... May
U. S. Phosphoric Products, Div., Tennessee Corp. 15
U. S. Potash Co. 8
U. S. Steel Corp. 75

Vanderbilt Co., R. T. 109
Velsicol Corp. 81
Virginia-Carolina Chemical Corp. 92
Vulcan Stamping & Mfg. Co. 116
Vulcan Steel Container Co. 104

Williams Patent Crusher & Pulverizer Co. .... May
Willson Products, Inc. .... May
Wisconsin Alumni Research Foundation 126
Woodward & Dickerson, Inc. .... May

Young Machinery Co. 123

Zonolite Co. 79

Tale Ends

Looks like we may have touched a nerve with our item in the April issue of AC expressing scepticism that the *Reader's Digest* had the right dope when they suggested that chemist Allen R. Kittleson was just stabbing in the dark when he discovered Captan. We are indebted to Robert L. Dunne of Esso Research & Engineering Co., New York, one of Kittleson's co-workers, for the advice that when Kittleson made the important Captan discovery, he knew just what he was looking for—an insecticide, a weed killer or a fungicide. SR-406, it turned out, proved to be a fungicide, and not an insecticide, as Kittleson had first suspected, which was the only surprise feature of the situation.

But the discovery was definitely not accidental. Captan was first tabbed by the Esso Research staff as SR-406, which of course carries with it the inference that 405 formulas had been tested before Captan was born.

Incidentally, the May issue of *Coronet* carries another article on Captan. While it does not give the story the old *Reader's Digest* treatment of having the sweep out lady accidentally brush the sensational new product into the test tube off the end of her dust mop, it tells an interesting story, and has the distinction of being much more factual than the usual slick paper magazine article about the great doings of science.

AC

In the face of repeated scare stories in the daily press to the effect that DDT is a "dangerous poison" which could be poisoning the entire nation, we note now that the chemical sister to this compound, DDD, has been injected into hopeless cancer patients at the University of Minnesota, successfully reducing their cancer-stimulating sex hormone output. DDD, it is reported, is completely safe, although it has some minor effects on the liver and blood organs.

AC

The April issue of the *Hercules Mixer*, house magazine of Hercules Powder Co., carries an article giving the story behind Hercules operation of company air planes. Ten years experience with operation of company planes has proved to Hercules management that they save both time and money. The primary use of the Hercules planes is to transport key personnel to the various Hercules plants around the country.

Hercules now operates two DC-3's and has completed 1,800,000 miles of accident-free operation. Owen Mayfield, Hercules' senior pilot, observes that since the planes can be "scheduled to fit the convenience of Hercules personnel, the airplanes give them more time in the plants and at home than is possible in commercial travel or by any other means. . . . Our planes can operate off the beaten track, and bridge places on the map that would be difficult if not impossible to achieve by commercial airplane."

AC

A Poison Control Center was launched in New York City recently, designed especially to meet emergencies resulting from use of insecticides, polishes, and other household products containing toxic chemicals. The center has a file of some 500 commercial forulas and their antidotes. If it can't supply the answer from its own files, it can readily reach technicians in the manufacturer's plant who know exactly what's in the product in question, and what to do about it.

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Congratulations to the June graduates!

These men and women will be taking their places in the business and community life of America.

Their enthusiasm, vision, and faith in the future help speed the growth and service of both business and agriculture.

Businessmen who make commencement addresses are helping create "giants of the future."

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TROUBLE AHEAD?

These growers are justly proud of their crop which has germinated and passed its first big test in the struggle for survival. But trouble is just around the corner. In the soil, or at the base of the plants, are early-season insect pests, ready to feed at the farmer's expense. As the plants mature, other insects will invade the field. To make a profit, this crop needs protection.

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